



FRIDAY, NOVEMBER 22, 1901.

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Contributions

Cost of Operating Turn-Tables By Hand and By Electric Power.

Chicago, Nov. 9, 1901.)
Chicago & North Western Railway. }

TO THE EDITOR OF THE RAILROAD GAZETTE.

I notice in the *Railroad Gazette* of Oct. 11 a report of the cost of operation of turn-tables, showing one of ours as costing \$13.40 for about 24 hours operated by hand and the same cost for 24 hours operated by electric power.

This was a mistake, as the labor of the two men days and two men nights shown in this table is as follows: It is the duty of one of these men on day shift and also on night shift to spot the engines in the house, put soda-ash in the tenders, keep the circle of the roundhouse clean and assist in drawing sand. So on about what seems to be the basis of the cost as reported by other roads, our cost would be \$4.95 for operating the turn-table for 24 hours by electric power for the labor only.

R. QUAYLE, *Sup't M. P. and M.*

[The table of costs which Mr. Quayle refers to was compiled by a committee of the Association of Superintendents of Bridges and Buildings and accompanied its report on operating turn-tables by power.—EDITOR.]

The Whistle Nuisance.

Cleveland, Ohio, Nov. 9, 1901.

TO THE EDITOR OF THE RAILROAD GAZETTE.

I have read with interest your editorial on noisy whistling; and I would like to suggest as an improvement for locomotive whistles a hood arrangement which would concentrate the noise of the whistle in the direction in which it is most needed. An arrangement of this kind is in use in fog horns in United States Government service, and I understand it is giving entire satisfaction.

For passenger engines the hood could be fixed so as to throw the entire sound forward. This would protect the ears of passengers from much annoyance. On freight locomotives the hood might be arranged to be under the control of the engineer, so that the opening could be turned either forward or backward.

FRANK C. OSBORN.

[It would not do to have a hood fixed to throw sound forward, or even to have that the normal position of a movable hood, unless a separate whistle were provided for emergencies; for one of the emergencies that must be kept in mind is the need of a whistle signal from the engine to call to duty the brakemen on the train drawn by that engine itself. It is true that on passenger trains this emergency is of very rare occurrence; but we are hardly ready, as yet, to ignore the contingency.—EDITOR.]

Fast Run on the Michigan Central.

On the 5th of September, train No. 31, of the Michigan Central, was run from St. Thomas, Ont., to Windsor, 229 miles, in 220 minutes, or at the rate of 62.45

miles an hour. As the cars in this train weighed, with their contents, about 430,000 lbs., the performance is worthy of note, even though the news is somewhat tardy; as so high a rate of speed for so long a distance has rarely if ever been made with so heavy a train. In all instances which we find on record, of runs as fast as this, the number of cars was not over three or four, but in this case there were five; a mail car, three express cars and one passenger car. We have not the exact weight of the train, but the first four cars were heavily loaded, and 215 tons appears to be a conservative estimate. The train was hauled by engine 481, Atlantic type, the dimensions of which are:

Cylinders.....	21 x 26 in.
Driving wheels.....	79 in.
Steam pressure.....	200 lbs.
Weight on drivers.....	95,000 lbs.
Weight on trucks.....	81,000 lbs.
Total weight of engine.....	176,000 lbs.
and tender.....	290,000 lbs.
Fire-box.....	Wide type
Heating surface.....	3,005 sq. ft.

Car Famines and the Pittsburgh District.

During the last two months the newspapers of many cities have had accounts of car famine and freight congestion which seems to have been most acute at Pittsburgh, to the injury of the industries and the commerce of that city. The blast furnaces have claimed that they could not get coke, the mills that their supplies of fuel and ore reached them so intermittently as to hamper operation, the mines that they could not ship coal; glass factories have threatened to remove to other localities; warehouse owners, storekeepers, grain and produce dealers and contractors have joined in a clamor that led to a special meeting of the Chamber of Commerce, which referred the matter to its Committee on Transportation, to which have come scores of letters the burden of which is that the railroads serving Pittsburgh are inadequately managed, and their directors and officers have been neglectful of the city's interest in not increasing facilities in correspondence with the expansion of the commerce; that they have been deplorably lacking in foresight in many directions. These formidable accusations were backed up by the long lines of freight cars in the yards and on the sidings throughout the Pittsburgh district and by the fact that almost any resident of the vicinity who has been a shipper or consignee during the past 10 weeks has a story of delay. But when the situation is subjected to analysis it does not appear that gentlemen who have worthily discharged their duties in the past have suddenly been stricken with the paralysis of inefficiency.

First of all it must be remembered that for a period of four years, which was ending but three years ago, the industries of the Pittsburgh district (and the rest of the country) were prostrate. In that city, through the effort of organized charity, employment was given to thousands of men whose services were not required in the mills and mines, and empty freight cars by the thousand stood idle on the side tracks. The problem that then confronted the railroad managers was to give employment to the nucleus of a disciplined force and at the same time to end the year without a debit balance. At that time newspapers and public men were voicing the opinion that manufacturing in this country had been overdone; that domestic consumption could not overtake the capacity for production for a decade if not for a generation to come; that the "pauper labor" of Europe not only smothered the thought of the disposition of a surplus abroad, but awakened the fear of our further suffocation by the importation of foreign products. In his rejoinder to Mr. Frick, in their noted controversy, Mr. Carnegie reminded him that he (Carnegie) alone of all the officers of the Carnegie Steel Company had in 1895 expressed confidence in the future supremacy of Pittsburgh as a steel center and had acted accordingly, it having been an often mooted question whether the proximity of Pittsburgh to coal was sufficient to overbalance the long haul of the ore and the flux.

Had the directors of a Pittsburgh railroad been told, along in 1897, that within four years there would come a time when double the track (miles of which was then useless), when double the cars (thousands of which were then idle), when double the locomotives (hundreds of which were then dead in roundhouses) would be all inadequate to handle the business that would offer, the informant would have been regarded as crazy. Yet that is exactly what has happened in the last two months.

The railroad officers, as some proof that they were not lacking in preparation for the future, point to the fact that thousands of new cars have been added to their equipment, largely of the capacity of 80,000 to 100,000 pounds, instead of 30,000 to 50,000 pounds, and to the fact that new designs of locomotives, of which many have been built, have increased the hauling power by 65 per cent. And they also claim that the volume of traffic, which has steadily increased from 1898, has been handled in a manner beyond reasonable criticism until this year; that while there are periods of ebb and flow in all traffic, and there has not been the freest movement at times of maximum pressure, yet, when such periods have been passed, normal movement has rapidly been regained.

An unusual extension of the facilities of a railroad company, either by the provision of new track or new equipment, is a matter requiring months in conception and execution, but the limits of the human intellect which confine the mental processes of railroad officers as well

as of other citizens render it impossible to foretell for any considerable period an unusual increase of traffic either in direction or degree. Railroad extension cannot be expected to lead the expansion of traffic, but it should make a sensitive response to such expansion, and this the officers of the Pittsburgh railroads claim it has done.

The Pittsburgh & Lake Erie has ordered more locomotives and cars during the past year than in any previous two years of its existence. The Pennsylvania Lines East and West, in addition to extensive orders for equipment, have under way plans for the extension of track and yard facilities which were put in process of execution when the increase of traffic seemed to be of assured permanence, as follows: The Monongahela Division on the south side of the city is being elevated and widened for four tracks for a distance of six miles, and the Panhandle Railroad on the same side is being widened for four tracks for a distance of 2½ miles. The completion of these improvements will further facilitate the sending of the freight that originates in the coke fields and the mills on the south side of the Monongahela River to the West and Northwest over the Ohio Connecting Bridge, thereby keeping it out of the Pittsburgh yards and off the Pittsburgh tracks. The yard of the Ft. Wayne road at Conway, through which East and West traffic is drilled, is being extended to hold 5,500 cars; the bridge of the Ft. Wayne road over the Allegheny River is being rebuilt because of the necessary elevation of the tracks through Allegheny. The Union Station at Pittsburgh is being rebuilt, the adjacent yards remodeled and the tracks reconstructed.

All of these improvements were expected to be completed or in such a forward state at the close of the summer that the autumn traffic—always large—could be handled satisfactorily. But the mills have been so backward in furnishing material that the contractors in no case have realized expectations, work in many instances that was to have been completed in July being from three to six months behind. Therefore, tracks that it was the intention to have clear for traffic are occupied by trains loaded with construction material. A striking example of this delay is afforded by the bridge of the Pittsburgh & Lake Erie Railroad over the Monongahela River, the contract for the double tracking of which was let early in the year, it being specified that the work was to be completed by Aug. 1. That work, however, is not yet finished, and likely will not be until January or February of next year. The ability of the Lake Erie road to handle traffic throughout this extraordinary pressure has been gauged by its weakest point, which is this bridge.

The autumn traffic, which always makes heavy demand upon the equipment and facilities of the railroads, is caused usually by the effort of shippers to complete contracts for the delivery of ore and coal to and from the lakes before Nov. 15, the date of expiration of insurance on lake traffic, and by the autumn movement of grain. The burden from the former cause was this year increased by reason of a strike of lake engineers postponing the actual opening of navigation for six weeks, and a conflict during the early summer between the coal shippers and the lake transportation companies over lake freight rates, the lake shipments of coal having been seriously curtailed until July 1, since which time the coal companies have endeavored to effect a shipment that normally would be spread over the entire period of navigation. The Eastbound movement of grain has not been so heavy during the past few weeks as usual, but the Westbound movement of merchandise has been far greater, the interior and Western States exercising the high purchasing power given by three years of great grain yield, for which there has been unprecedented demand. The cars containing this Westbound merchandise are slow in getting home.

The strike of the steel workers, which continued from June until September, forced a considerable postponement by the mills in filling orders, and their customers, becoming importunate, immediately after the termination of the strike, brought a clamorous demand upon the railroads for cars for ore, limestone and fuel and for the removal of the finished product, it being the claim of the railroads that the steel companies are, therefore, endeavoring to compress into three or four months a movement that would ordinarily be distributed over six or eight.

The prosperity of the Pittsburgh district is shown in a wonderful volume of building. The exceptional continuance of weather permitting out-of-door work, and previous delays in getting material and workmen, have impelled the contractors to push such work to the last stage before the coming of winter, and they have joined in the siege that has made the railroad superintendent's life not a happy one. This same prosperity is also manifest in the stocks of merchandise that heap the warehouses, stores and shops of Pittsburgh, and in the unwonted orders that have been given for yet other stores to supply the winter and holiday demand. This condition is reflected on the table of the Pittsburgh workmen. Produce yards of the Pennsylvania Lines that were open two years ago with a capacity of about 300 cars, which then seemed excessive, the other day being jammed with over 500 cars filled with things to eat. The quantity of inbound freight is so vast that at times, when the freight stations have been piled to the roof, consignees have been unable to obtain the teams and horses with which to remove it. This means that cars of inbound freight in the yards could not be unloaded, and yet other

cars had to be held on side tracks awaiting the clearing of the yards.

It will thus be seen that an extraordinary pressure arising in part from abnormal causes has borne upon the Pittsburgh railroads at a time when they have been peculiarly and abnormally straitened, and their embarrassment has been aggravated by other causes yet to be named. It seems that the water supply for the boilers of the railroad locomotives in Allegheny County is the Allegheny, Monongahela and Ohio rivers. Into these rivers, particularly the two former, the water of which is mostly used by the railroads, there drains sulphur from the mines and various offal from the mills, and because of the long-continued drouth of this year the river water has not been diluted to the degree of good boiler water. Eleven locomotives on one railroad were recently disabled from this cause in one night.

The foregoing considerations are advanced by the officers of the railroad companies, who also point out that a mill or factory can refuse an order when it is working beyond its capacity, while a railroad cannot well refuse shipments. It is but just to say, however, that there are points upon which the statements of the railroad officers and the heads of the industrial establishments diametrically differ. For example, the officers of the great steel mills deny that the three months' strike caused a concentrated traffic after its cessation. The railroad officers say that the furnaces and mills will not stock raw material, insisting that it be delivered in cars at such times and in such quantities as meet their requirements, and that during the past summer the tracks have at times been blocked with trainloads of material which the consignees could not unload. On the other hand, it is claimed that at many of the mills the additional expense of stocking would have been gladly incurred if material had been delivered in excess of immediate needs. It is admitted by the head of one of the greatest of the world-famous steel companies that there probably is not a blast furnace in the Pittsburgh district that did not break all records in October. This would hardly indicate a breaking down of the railroads under the strain, but simply that transportation facilities did not expand to the full demand of shippers and consignees, whose plants were being pushed to a hitherto unknown maximum. The railroads also point out that during the past five years there has grown the practice of wholesale merchandise dealers who formerly occupied warehouses to simply rent an office and distribute and reassign merchandise directly from the cars, a proceeding which is necessarily not as expeditious as the complete unloading of a car immediately upon receipt, and which practice in the aggregate is a considerable impediment to the movement of freight.

It is doubtless true that the operation of the railroads has been hampered to an extent because equipment and structure are in a transition period, all parts of equipment and all components of structure not having been brought abreast of the advance in car building marked by the introduction of the heavy steel car. Further, it is reasonable to say that the trouble about water could have been foreseen.

The demand for the immediate movement of coal and ore during the two months prior to the close of lake navigation naturally compelled an unusual and perhaps an undue degree of attention on the part of trainmen to the despatch of these commodities which move in trainloads usually to a single destination, merchandise in carload and broken carload lots of different kinds for different stations tending to be forced on sidings to leave main tracks clear for the train movement, the volume of which continuing for several weeks increased the tendency of merchandise to become stalled. A business man of Pittsburgh says that all the trouble arose from the railroads having too many sidetracks, that goods became pigeon-holed on these tracks, and there remained. The Pennsylvania Lines appointed a terminal agent especially charged with seeing that the yards were worked to their maximum for the reception and discharge of this merchandise.

In the Pittsburgh district material and supplies of various kinds are purchased by one mill or factory from another and there is, therefore, a vast cross movement from one part of the region to another. During the period of congestion the mill operators were particularly bitter in their complaints that the railroads were dilatory in moving this cross freight. The force of this statement the railroads admit to an extent, saying that it has been necessary to keep the main tracks clear wherever possible for the movement of through freight and through passenger traffic; that this cross freight has possibly suffered worse than local freight because of the nature of its demands upon their facilities, it being impracticable to move it, except at night and during the time of heaviest pressure, impracticable at times to move it at all.

The measure of blame, if blame there be, for the congestion at Pittsburgh, the existence of which no one denies, cannot be justly apportioned between the railroads and the business interests except perhaps by a court of inquiry, and even such a court likely could not obtain the statistics necessary as a basis for its deliberation. The fact that the Pennsylvania System has under way the improvements hereinbefore mentioned and that it has recently placed orders for 19,000 freight cars—and the magnitude of this order is utterly without precedent—certainly shows that these lines do not hesitate to take radical steps toward keeping abreast of the future. The

Vanderbilt System, which includes the Pittsburgh & Lake Erie Railroad, is not lacking in enterprise, and there is reason to believe that the Baltimore & Ohio Railroad, under its new management, will soon be in position to respond to the demands of traffic as never before.

It must not be forgotten that a railroad company is obliged to be exceedingly circumspect in acquiring real estate necessary for the broadening of its right of way. The same citizens of Allegheny who have belabored the Fort Wayne Railroad for not promptly handling traffic have arisen in wrath when it has endeavored to obtain more land for more tracks. When it was divulged that the Pennsylvania had formulated plans for new yards, immense and elaborate, the price of property which it desired to acquire was at once advanced 50 per cent.

L. G. M.

Prairie Type Passenger Locomotives—Atchison, Topeka & Santa Fe.

The Baldwin Locomotive Works are building and have delivered some Vauchain compound Prairie type passenger locomotives for the Atchison, Topeka & Santa Fe, which are the most powerful passenger locomotives built. The weight on driving wheels in working order is about 135,000 lbs., the total weight 190,000 lbs., and the tender loaded weighs about 112,000 lbs. The cylinders are 17 and 28 in. x 28 in., the driving wheels 79 in. in diam., and the steam pressure 200 lbs. The boiler is very large, having 3,738 sq. ft. of heating surface. The grate area is 53.5 sq. ft. and the fire-box is 9 ft. long and 5 ft. 11 1/4 in. wide, with two fire-doors. The tubes are 19 ft. long. The accompanying illustrations show a general resemblance to the Class J passenger locomotives of the Lake Shore & Michigan Southern, illustrated in the Railroad

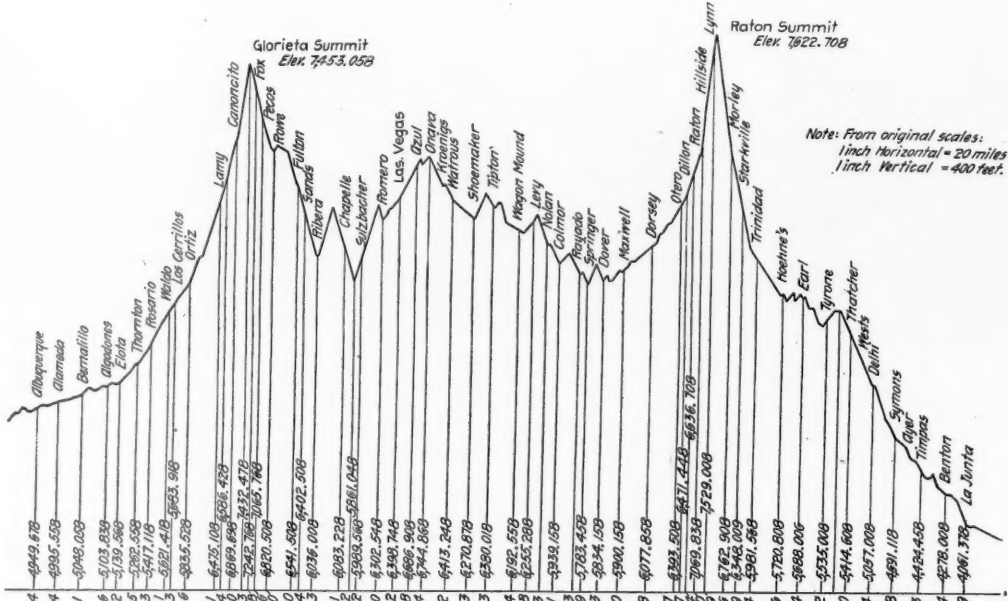
the Class J locomotives of the Lake Shore. The Santa Fe locomotive has very nearly 70 sq. ft. of heating surface per square foot of grate and the Lake Shore locomotive has nearly 69 sq. ft. The total weight per square foot of heating surface is 50.8 lbs. for the Santa Fe locomotive, and 52.1 lbs. for the Lake Shore locomotive. The Class J locomotives on the Lake Shore have shown economy in fuel and remarkable ability to haul heavy trains at high speed. There is a good field for the Santa

Summary of Grades and Curves—La Junta to Albuquerque.

From	Max. Grades, Ft. per Mile.		Sum of Ascents, Ft.		Curvature.	
	West.	East.	West.	East.	Maximum.	Total.
La Junta to Trinidad.	59.7	31.7	2363.81	443.02	7 deg. 30 min.	1587 deg. 3 m.
Trinidad to Raton.	184.8	175.3	1643.64	988.50	10 deg.	2729 d., 28 m.
Raton to Las Vegas.	69.7	70.7	2074.05	2312.01	6 deg. 10 min.	2719 d., 13 m.
L. Vegas to Thornton.	89.8	158.4	2248.80	3384.99	10 deg.	7389 d., 40 m.
Thornton to Alb'qr'g'e.	21.1	26.4	110.46	223.34	8 deg. 20 min.	7381 d., 45 m.

Fe locomotives, in which to do heavy and fast work, some reference to which is made elsewhere in this issue.

The special equipment of the Santa Fe engines includes: Nathan lubricators and injectors; Westinghouse air-brakes; Leed's reversible pilot couplers and Tower tender couplers; Crosby safety valves and steam gages; Leach sanding device; Jerome metallic piston and valve rod



Profile of the Atchison, Topeka & Santa Fe—La Junta to Albuquerque.

Gazette, March 29, 1901, but the fire-box design is quite different. To facilitate comparison the principal dimensions of these two locomotives are given in the following table:

	A. T. & S. F.	L. S. & M. S.
Road	Baldwin	Brooks
Builder	Prairie	Prairie
Type	17 and 28	20 1/2
Cylinders, diam. (in.)	28	28
Cylinders, stroke (in.)	28	28
Drivers, number	6	8
Drivers, diameter (in.)	79	80
Steam pressure (lbs.)	200	200
Weight on drivers (lbs.)	135,000	130,000
Weight on leading truck wheels (lbs.)	25,000	21,500
Weight on trailing truck wheels (lbs.)	30,000	23,000
Weight, total (lbs.)	190,000	174,500
Heating surface, tubes (sq. ft.)	3,543	3,169
Heating surface, fire-box (sq. ft.)	195	174
Heating surface, total (sq. ft.)	3,738	3,343
Grate area (sq. ft.)	53.5	48.5
Wheel base, total, of engine (ft.-in.)	32-2	31-10
Wheel base, driving (ft.-in.)	13-8	14-0
Length over all, engine (ft.-in.)	46-3	43-5
Length over all, engine and tender (ft.-in.)	69-7	68-10 1/2
Height, center of boiler above rail (in.)	112	110

Boiler, type	Straight Top	Extended Wagon Top
Boiler, diameter of barrel (in.)	70	66
Tubes, number	318	285
Tubes, diameter (in.)	2 1/4	2 1/4
Tubes, length (in.)	228	228
Fire-box, width (in.)	71 1/4	84
Fire-box, length (in.)	108	85
Fire-box, depth front (in.)	76 1/2	68
Fire-box, depth back (in.)	67 1/2	68
Tender, weight (lbs.)	112,000	118,000
Tender, water capacity (gallons)	6,000	6,000
Tender, coal capacity (tons)	10	9 1/2

From this it is seen that the Santa Fe locomotives have larger boilers and weigh about 15,000 lbs. more than

packing and the Linstrom siphon on the tender. Further information follows:

Kind of fuel to be used	Coal
Wheel base, total (engine and tender)	57 ft. 9 in.
Height of stack above rails	15 ft. 6 in.
Drivers, material of centers	Cast Steel
Truck wheels, diameter	Front. 42 1/2 in. Back. 49 in.
Journals, driving axle, size	Main. 10 x 12 in. Others. 9 x 12 in.
" truck " " "	Front. 6 1/2 x 12 in. Back. 7 1/2 x 12 in.
Main crank pin, size	7 x 7 in.
Piston-rod, diameter	Hollow, 4 1/2 in.
Kind of piston-rod packing	Metallic
Main rod, length center to center	7 ft. 8 1/2 in.
Steam ports, circular, length	34 in.
" " width	1 1/4 in.
Exhaust ports, circular, length	34 in.
" " width	4 1/4 in.
Bridge, width	3 and 2 1/4 in.
Valves, kind of	Balanced Piston, 15 in. diam.
" greatest travel	5 1/2 in.
" outside lap	H.P. 3/4 in. L.P. 3/4 in.
" negative inside lap	H.P. 3/4 in. L.P. 3/4 in.
" lead in full gear	H.P. 3/4 in. L.P. 3/4 in.
Boiler, material in barrel	Steel
" thickness of material in barrel	1 1/4 and 3/4 in.
Seams, kind of horizontal	Butt Jointed, Double Covering
" " circumferential	Strips, Sextuple Riveted
Thickness of tube sheets	Both 1 1/2 in.
" crown sheet	1 1/2 in.
Crown sheet stayed with	1-in. Radial Stays
Dome, diameter	31 1/2 in.
Fire-box, material	Steel
" thickness of sheets	Crown, Sides and Back, 3/4 in.
" brick arch	Yes
" water space, width	Front, 4 1/2 in.; Sides, 4 in.; Back, 4 in.
Grate, kind of	Rocking, in four sections
Smoke-box, diameter	.72 1/2 in.
" length	72 in.
Exhaust nozzle	Single
" diameter	Permanent
" distance of tip below center of boiler	.6 1/2 in.

Netting	Steel Wire
mesh	2 x 2 per inch
Stack	Taper
least diameter	15% in.
greatest diameter	17% in.
height above smoke-box	3 ft. 0 in.

Tender.

Type	Swivel Trucks
Tank capacity for water	6,000 gals.
Coal capacity	10 Tons
Kind of material in tank	Steel
Thickness of tank sheets	15/16 in.
Top and Bottom	15/16 in. Sides, 3/4 in.
Type of under-frame	10-in. Steel Channel
Type of truck	Metal
Truck with	Rigid Bolster
Type of truck spring	Elliptic
Diameter of truck wheels	34 1/4 in.
and length of axle journals	5 x 9 in.
Distance between centers of journals	6 ft. 4 in.
Diameter of wheel fit on axle	6 1/2 in.
of center of axle	5 1/2 in.
Type of truck bolster	1-beam
Length of tender frame over bumpers	21 ft. 4 in.
Length of tank	20 ft.
Width of tank	10 ft.
Height of tank, not including collar	5 ft. 4 in.
Height of tank over collar	6 ft. 3 in.
Type of back draw-head	Miner Draft Rigging with Tower Coupler
Without water scoop	

Meeting of the Naval Architects and Marine Engineers.

On Nov. 14 and 15 the ninth general meeting of the Society of Naval Architects and Marine Engineers was held in New York City. The officers elected were: President Griscom, re-elected; Francis T. Bowles, additional Vice-President; Prof. I. N. Hollis and D. W. Taylor, additional members of the Council; Stevenson Taylor and W. L. Capps, ex-officio, to be members of the Executive Committee. Mr. Capps was re-elected Secretary and Treasurer.

Below are extracts from a few of the papers that were presented. The complete list of papers presented was published in our issue of Nov. 1, page 763.

TRIAL OF SPEED, STEAMERS "CITY OF ERIE" AND "TASHMOO."—BY FRANK E. KIRBY, ESQ.

On June 4, 1901, a trial of speed took place on Lake Erie between the paddle steamers "City of Erie" and "Tashmoo." The course was straight and the distance measured was 94 statute miles. Computed from the latitude and longitude of the lighthouses at Cleveland and Erie, and corrected for location of starting line, the distance is 94.31 miles. Measured on the chart issued by the Hydrographic Office of the Navy Department, the distance is 95.25 miles. The calculations in this paper are based on a distance of 94 miles. The average depth of water along the course was 61.31 ft.; minimum depth, 35 ft.; maximum depth, 77 ft. Weather fine; sea smooth.

The "City of Erie" is a passenger and deck freight steamer, owned and operated by the Cleveland and Buffalo Transit Company. Engine, single, compound beam, driving Feathering paddle wheels. Boilers, six; cylindrical, return tubular. Pressure of steam, 130 lbs. Coal used on the run of June 4 was select bituminous lump from the Youghiogheny district of the Pittsburgh Coal Company's "Eclipse Mine."

The "Tashmoo" is an exclusively passenger steamer, owned and operated by the White Star Line. Engines, inclined, triple expansion, driving Feathering paddle wheels. Boilers, cylindrical, return tubular—two double ended, and three single ended. Steam pressure, 175 lbs. Coal used when running with "City of Erie" was bituminous, from the Jackson Hill Mine, Jackson County, Ohio.

Particulars of the steamers and data of speed trial on June 4, as follows:

	City of Erie.	Tashmoo.
Length over all, ft.	324	308
on keel, ft.	314	300
Beam, ft.	44	37.5
Depth, ft.	18	13.5
Draught, forward, ft.	9.75	8.12
aft, ft.	10.83	8.46
mean, ft.	10.29	8.29

Displacement, tons	2,233	1,224
Trial load, tons	256	60
Engine, type	Compound, beam.	Triple, inclined.
Cylinder, H. P. diameter, in.	52	33
" I. P. diameter, in.	80	51
" L. P. diameter, in.	96	82
" stroke, in. H. P.	144	72
Boilers, cylindrical, number	6	5
diameter, ft.	12.5	11.08
length, ft.	11.75	3 of 11.33
furnaces, diam. in.	46	2 of 22
grate, length, ft.	5.5	6
" surf., sq. ft.	252	294
heating surf., sq. ft.	11,580	8,750
Draft system	Howdens.	Natural.
Steam pressure, lbs.	130	175

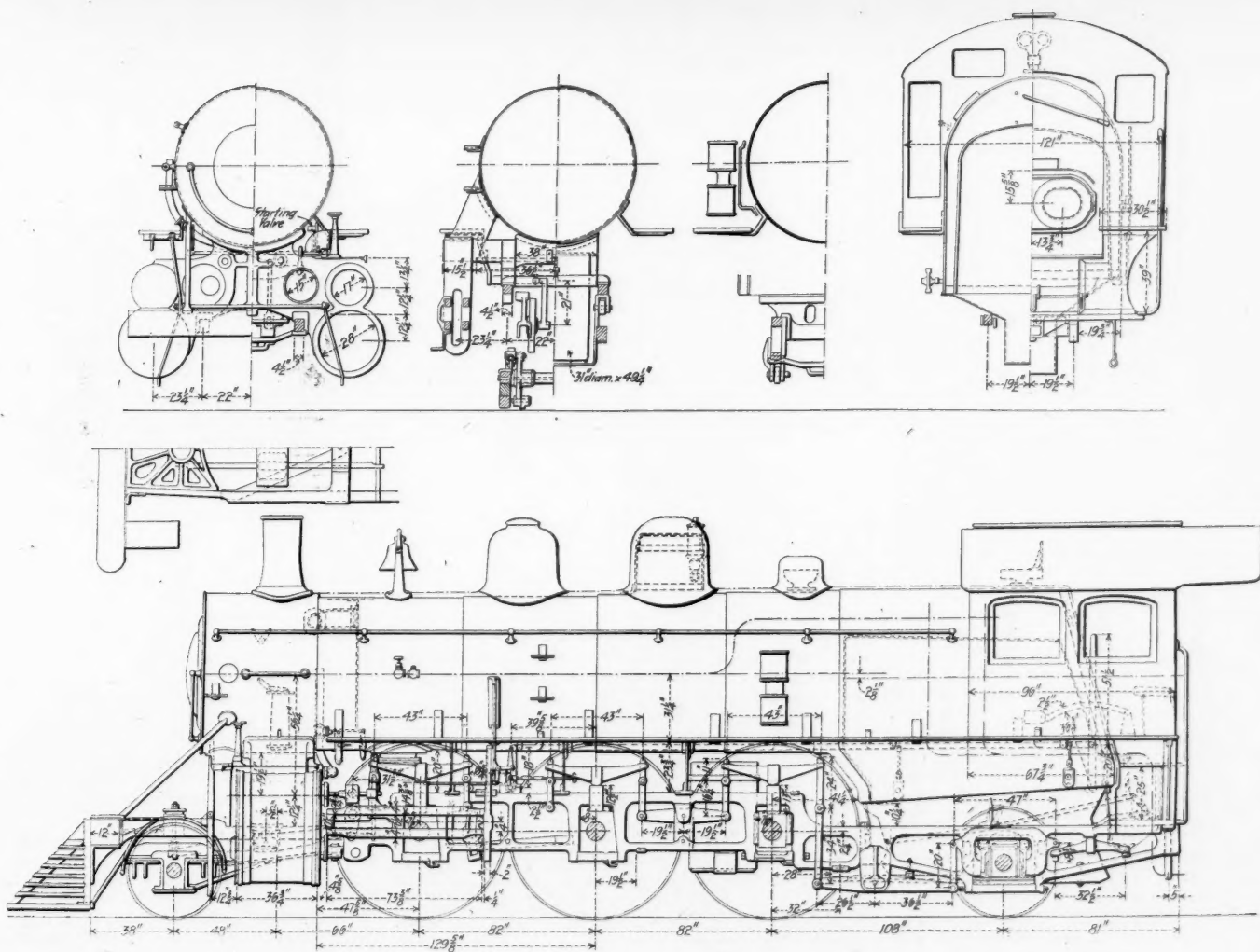
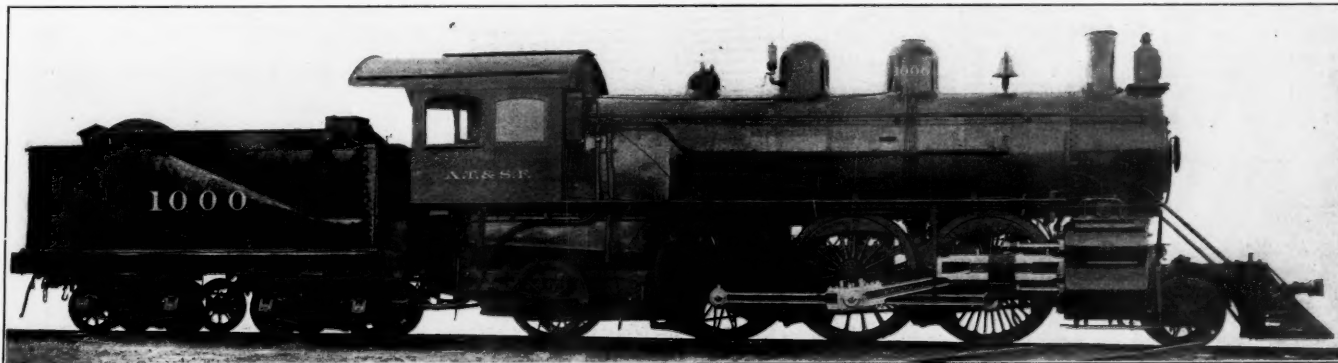
The following are data of the run:

Steam pressure, lbs.	120.4	175*
Vacuum, in.	23.5	22
Air pressure, in.	5 max.	
Revolutions per minute	33.25	40.08
I. H. P. total	6,472.3	3,400†
I. H. P. per sq. ft. of grate	25.68	11.58
H. S. per I. H. P. sq. ft.	1.79	2.57
I. H. P. per 100 sq. ft. of wetted surface	50.66	39.1
Distance, in statute miles	94	94
Speed, in statute miles	21.76	21.70
in knots	18.899	18.847
Slip of wheel over bucket, per cent.	35.65	32.2
*L. P. pass-over valve half open during last one and a half hours. †Estimated.		

The trial resulted in the "City of Erie" beating the "Tashmoo" 45 seconds in a run of 94 miles—less than half a second a mile. It is estimated that the speed would have been at least one-quarter of a mile an hour greater had the steamers been in water of sufficient depth not to be influenced by the bottom.

POWER IN PROPELLING THE WHITEHEAD TORPEDO.—BY FRANK M. LEAVITT, ESQ.

The results of these tests may not be considered a very valuable acquisition to science. But the apparatus used in making them is quite novel and capable of being effi-



Prairie Type Passenger Locomotive—Atchison, Topeka & Santa Fe Railway.
Built by the Baldwin Locomotive Works.

MR. G. R. HENDERSON,
Asst. Supt. Machinery.

MR. JOHN PLAYER,
Supt. Machinery.

ciently applied in other directions as, in fact, has since been done. The trials have also led to certain deductions relative to the frictional resistance of smooth surfaces passing through water, which have a permanent value. The data are the net results of a large number of tests upon several hundred torpedoes. The trials have consisted of, first, a series of shop tests of the motive power as measured by an absorbing dynamometer; and, second, runs made by the torpedo over a measured range under service conditions. In the latter case, as the operation of the torpedo is beyond observation or control, it would be difficult, not to say impracticable, to attempt any direct measurement of engine performance. These service runs are made for the purpose of fulfilling certain contract requirements, and the only data derived from them bearing upon the problem in hand are, first, the speed maintained over the range; and, second, the amount of compressed air expended in driving the torpedo at this speed. By the shop test, the amount of energy exerted at the propeller shaft is determined for each pound of air expended by the engine. By combining the results of these two series of tests, the shaft horse-power required to drive the torpedo at the observed speeds may be estimated.

The motive power is compressed air. It is stored in a steel flask, which forms the middle body of the torpedo, and occupies about one-half its displacement. In the short torpedo, and in the long Mark I, the maximum pressure of air carried is 1,350 lbs. The flask of the long Mark II is heavier, and carries a pressure of 1,500 lbs. The weight of air carried at these pressures varies somewhat with the weather conditions, but will average about 48 lbs. in the short torpedo, 65 lbs. in the long Mark I, and 80 lbs. in the long Mark II. The main engine is of the three-cylinder Brotherhood type, taking air on one side only of the pistons. The three connecting rods work upon a single crank pin, and one cam upon the crank shaft operates in succession the three engine valves, which latter are of the piston type. The valves are set to cut off at one-third the stroke of the pistons.

To regulate at will the distance which the torpedo shall travel, a device is attached to the throttle valve, operated by a train of mechanism from the crank shaft which automatically closes the throttle when the predetermined distance has been traversed.

There are two propellers tandem. The after one is attached rigidly to the main shaft and the forward one to a sleeve, concentric with the shaft, but made to revolve in the opposite direction by means of a system of mitre gears. The propellers must, therefore, be right and left-hand. The object of this arrangement is to neutralize the tendency which a single screw would have to rotate the torpedo bodily on its longitudinal axis. As it is entirely submerged and has a metacentric height of only about $\frac{3}{16}$ in. it has not sufficient stability to withstand such a force.

As already stated, the two factors to be determined by the shop test are the weight of air passing through the engine, and the corresponding foot pounds of energy delivered at the shaft. The plan generally adopted to weigh the air consists in attaching a pressure gage to the flask to enable the pressures therein before and after the test to be noted. Knowing the cubic capacity of the flask, the weight of air can be calculated. With proper precautions it is found by comparison with the other method of direct weighing that the results are quite accurate and to be relied upon. In order to simplify the calculation, tables have been prepared giving the weight of the contained air for the various pressures and shop temperatures.

The other factor to be arrived at, viz., the energy delivered by the engine at the propeller shaft, is determined by means of an absorbing dynamometer attached to the shaft in lieu of the propellers. For this purpose none of the ordinary forms of Prony brake was considered suitable. The duration of the test being limited to one minute or less, it would be difficult to obtain accurate measurements with so unwieldy an instrument. Recourse was, therefore, had to a plan suggested by Prof. Webb, of Stevens Institute. His idea was that a number of smooth metal discs revolving in water could be made to absorb the power of the engine by their surface friction. The rotative tendency would be transmitted to the water, and through it as a medium to the vessel containing it. If, then, the latter were mounted in suitable bearings and free to turn concentrically with the engine shaft, by resisting this tendency with a spring balance, the torque could be measured the same as with a Prony brake. At a given speed of rotation the frictional resistance would be constant, so that, by properly proportioning the areas of the discs, an engine of any given horse-power could be controlled at the desired speed of revolution. Prof. Webb kindly furnished me with a sketch of his idea, but he did not go so far as to suggest the proper number of the discs nor the size they should be made, and I could find no published data to aid me in determining these rather important details.

It was decided that four discs, each 2 ft. in diam., revolving in water at 900 r.p.m., should absorb fully as much or more power than is required to drive the torpedo through the water at a speed of 46 ft. a second.

The combined area of four such discs is just about one-half the area of wetted surface of the torpedo. I did not have sufficient faith in the calculations to trust entirely to them, and so built the first dynamometer with six discs 2 ft. in diam. in place of 4. Upon attempting to use it, however, the reasoning was vindicated, and I found it necessary to remove two of the discs.

The original scope of the trials did not extend beyond making a comparison between newly-built engines and those already tested in service runs and known to possess the required efficiency to obtain contract speed. By the aid of a table these trials were reduced to a shop routine conducted by the workman in charge of assembling the engines.

The following table gives a summary of the results deduced from a large number of trials:

Type of Torpedo.	Range in yds.	Pressure carried in air flask.	Weight of air used during run. Lbs.	Total work done by engine at shaft ft. lbs.	Duration of run, seconds.	Observed speed kts. per hr.	Shaft horse-power.	air cold
3.55 M. Mark I and II.....	800	1,350	30	750,000	53.3	26.66	25.6	" cold
5 M. Mark I.....	800	1,350	42.3	1,057,000	51.6	27.52	37.2	" "
5 M. Mark II.....	800	1,500	44.5	1,112,500	49.8	28.54	40.6	" "
" ".....	800	1,500	51.6	1,806,000	42.4	33.5	77	" hot
" ".....	1,500	1,500	62	1,550,000	115.5	23.5	24.4	" cold
" ".....	1,500	1,500	63.4	2,219,000	96.3	27.6	41.9	" hot

LATE DEVELOPMENTS IN ORDNANCE AND ARMOR.—BY J. F. MEIGS, ESQ.

In the past 10 years the developments in armor plate have consisted in, first, the introduction of nickel in the armor; second, the adoption of the super-carbonizing process invented by Mr. Harvey; and, third, the perfecting of this super-carbonizing process by Krupp. . . . In the ten years under review the advance in the resisting power of armor has been very material. . . . It is perhaps not too much to say that the armor of to-day has 40 or 50 per cent. more power to resist penetration than that of 10 or 12 years ago of the same thickness. Its power to resist cracking is very difficult to measure numerically. This power, however, is very greatly in-

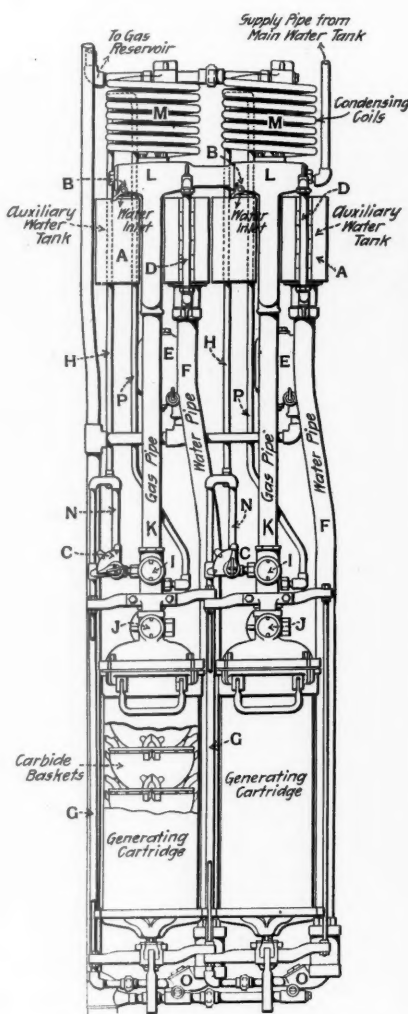


Fig. 1.—The Adlake Acetylene Gas Generator.

creased, as much because of the better methods of melting and forging large masses of steel, as for any other reasons. It seems now almost impossible to crack well-made armor plates under conditions approaching those usual in reception tests. Their surfaces are spalled for an inch or two depth, and the tough back of the plate is very resisting to cracking effect. . . .

The advantage which is most marked in the past decade in ship's guns is in rapidity of fire. Not many weeks since an English ship of war fired eight shots from a 6-in. gun in one minute, at a range of about 1,500 yards, at a target 15 ft. high, and struck it every time. . . . We hear, also, of guns, whose projectiles weigh 350 lbs., being fired three or four times a minute. These things are no doubt true, in at least a limited degree, and constitute a very marked advance in gunnery, for, while it would not be possible to fire a 6-in. gun many minutes at eight rounds per minute, both because the crew would become exhausted and because the gun and other parts would heat, yet the fact that this can be done for a short

The Adlake System of Acetylene Gas Car Lighting.

After calcium carbide had become a commercial product the Adams & Westlake Co., Chicago, began an exhaustive study of the problem of lighting passenger cars with acetylene gas. A long series of experiments was made, followed by service trials. At present a large number of cars are equipped with the Adlake system of acetylene gas lighting and have been in regular service for from

one to two years. This service has proven the practicality and correctness of design of the apparatus as well as the economy of this system of lighting. Now the company is prepared to build acetylene gas lighting apparatus for passenger cars on a large scale, with assurance that the results will be satisfactory to railroads.

The apparatus has been made to meet the following general conditions: Absolute independence of the lighting equipment of each car; unlimited supply of gas; economy of operation; economy of space; durability of construction; simplicity of operation; cleanliness and absence of odor; protection against freezing of water, and the absence of danger. A brief explanation of how these several conditions have been met can well precede a detailed description of the apparatus.

In the Adlake system each car carries its own gas plant. The calcium carbide is put in air-tight cartridges which are easily portable and can be carried on the car, in the baggage car or distributed along the road by trains from a central point. The cartridges are all interchangeable. A charged cartridge weighs about 50 lbs. and

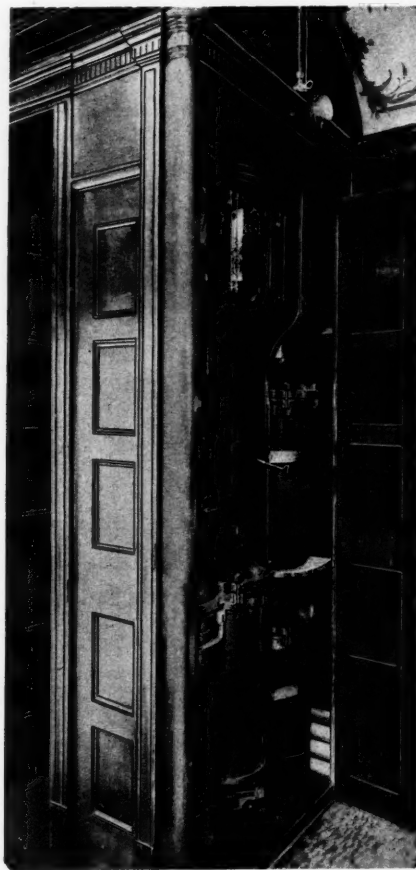


Fig. 2.—Location of Adlake Acetylene Gas Generator in Car.

the weight of the cartridge after the carbide has been used is about 65 lbs. The gas supply is only limited by the arrangements for carrying or distributing the charged cartridges.

The cost of calcium carbide in large lots is about \$70 a ton, and approximately 5 cu. ft. of gas are got from each pound of carbide; making the cost of carbide alone, $\frac{7}{10}$ cent per cubic foot of gas. To this about 11 cents per car per night should be added for attendance and other similar items to get the total cost of operation. Each burner uses $\frac{3}{8}$ cu. ft. of gas an hour. In recent coaches 21 burners have been used, 31 burners in dining cars and 42 burners in parlor cars. These figures can be safely used in estimating the cost of acetylene gas lighting with this system. A test for one week with a 10-car train gave a total cost for acetylene gas lighting of 46 cents per car per night.

The Adlake generator doubtless occupies the smallest space of any used for car lighting. It is designed to go on a partition, a space being required 22 in. wide horizontally and 6 ft. 6 in. vertically, and the apparatus projects 10 in. from the partition.

(Continued on page 806.)

As to construction and operation in general, there are no automatic movable mechanical parts to regulate the water supply or the feeding of the carbide. The generation of gas depends on the quantity of water fed to the carbide and the quantity of water fed to the carbide is in turn regulated by the consumption of gas. The water enters the carbide cartridge and leaves the cartridge through the same opening, so that no water passes until

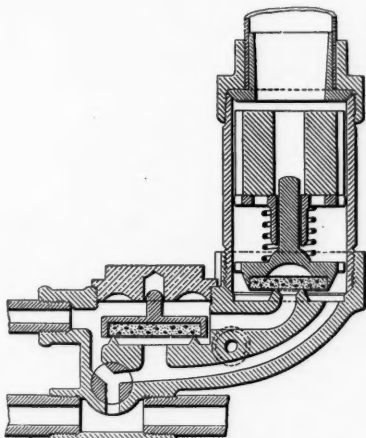


Fig. 3.—Combination Drain, Check and Weight Valve.

the back pressure of the gas is reduced by consumption below the pressure due to the water column; then water enters and the generation of gas continues. There are but two movable parts to the generating apparatus.

The generating cartridges can be charged and discharged by the same class of labor which now cares for oil lamps, and this work is done away from the car. The main water tanks are filled from the outside of the coach and by the same men that fill the other tanks on the car. The machine proper can be attended to by any class of employees desired, as it is only required to fill the auxiliary water tanks, place the generating cartridges in position and operate three valves. The valves are so interlocked with the mechanism holding the cartridges in place that they can only be worked in proper order. Colored porters on chair cars have no difficulty in operating these machines and in other cases they are cared for by train crews.

As the gas is generated as used, only a small quantity

be sufficient to form an explosive mixture. In case a car is overturned by accident a weighted blow-off valve allows all the gas in the generator to escape. The water normally being above the carbide, when the car is overturned no water can reach the generating cartridge. Also, as the carbide is confined in the cartridge none of it can reach the water; so the generation of gas ceases under such conditions.

Cleanliness and the absence of odor from gas are provided for by charging and discharging the generating cartridges outside of the car. In changing cartridges, the escape of gas is prevented as the valves are interlocked and must be correctly operated before the cartridge can be removed. Each section of the apparatus is fitted with a drainage cock so that all water can be drained off when it is necessary to shut off the heating apparatus in cold weather.

The accompanying diagram, Fig. 1, shows the construction of the generator and Fig. 2 shows how it is mounted in the car. This generator consists of two units. A main water tank, not shown in the diagram, is placed at some convenient point in the car above the machine and this tank is filled from the outside in the same way that the other water tanks of the car are filled. This main tank holds about 15 gals. of water, or enough for three or four charges of each of the auxiliary water tanks. To fill the auxiliary water tanks, A A, the key valves, B B, are opened after the three-way valves, C C, and the drain valves are in the closed position. The water is then allowed to flow until the water gages, D D, show that the auxiliary tanks are full and the water is heard overflowing. This overflow fills the water-seal traps, E E. When the auxiliary tanks are full of water the pipes F F and G G are full and water extends upward in pipes H H, level with the water in the auxiliary tanks.

To start generation, the key valves I I are turned fully to the right and then valves J J are opened in the same way. One three-way valve C is then turned to the No. 1 position and the other three-way valve C is turned to the No. 3 position. In the No. 1 position the horizontal passage through the valve is open and in the No. 3 position this passage is closed and the passage through the upper cross-pipe is open.

The water now passes through pipe F, past a special check valve O, shown in detail in Fig. 3, and rises in pipe G to the cock C; thence through the lower cross-pipe and combined gas and water cock I and into the generator. As the water and gas both pass through the same chamber in the neck of the generator, the pressure of the gas controls the flow of water into the generator. When the gas pressure is greater than the pressure due to the water column, the flow of water stops and the feeding of water again occurs when the gas pressure is reduced below the water pressure. To insure sufficient generation to maintain the number of lights required, the apparatus works under a water pressure of about one pound, corresponding to a column of water of 27 in., or the height of the auxiliary tank above the cock C. There is a slight variation in this water column due to differences in the depth of the water in the auxiliary tank, but this is not enough to affect the working of the generator.

The gas when generated passes through the vertical gas pipe K directly above the generating cartridge and through the cast head L into the cooling coils M. The cast head is provided to receive any water from condensation that may collect in the gas pipe and be forced up by reason of the gas pressure; also to prevent this water from getting into the cooling coils and piping. The cooling coils condense any moisture in the gas and the piping is all arranged so the drainage is back into the generating cartridges.

From the cooling coils the gas passes through a scrubber and then to a small storage tank beneath the car. The pipe to this tank is run inside the car and is joined to a large header which extends through the car floor. This arrangement of piping is to prevent difficulties from frost collecting in the pipes in very cold weather. From the storage tank the gas passes through a regulating valve to the service pipes, the regulator being set to give a service pressure of 1½ oz.

The equipment for a coach consists of two generating units as shown. In order that these machines may automatically change generation from one to the other and require no attention after starting, the U-shaped pipes N N and the valves C C are provided. The two generating cartridges are under the same gas pressure being connected through the gas pipes K K and the cast heads L L. Also, it will be seen that the water for the generator which works first passes through the horizontal passage in valve C, and a gas pressure slightly over 1 lb. in the generator stops the flow of water through this horizontal opening. As the same gas pressure is in the second generator no water will be admitted until the charge in the first generator is about exhausted. This is because the water pressure on the second generator is less than on the first, the head of water being the distance between the water in the second auxiliary tank and the top of the U-shaped pipe N. Generation commences in the second generating cartridge when the gas pressure in the generator is reduced to a point equal to or below the weight of the shorter column of water. This automatic feeding device is so arranged that it can be worked either forward or back, in accordance with the setting of the valves C C.

So long as there is any dampness in the generating cartridges, generation will go on after the water has stopped flowing, this action being known as "after generation." Provision is made to save as much of this gas

as possible. A back pressure weight valve O, shown in detail in Fig. 3, is placed at the bottom of each of the water pipes, F F. The tank underneath the car takes care of this excess gas. The gas is stored in the tank until the back pressure exceeds the weight of the back pressure valve, which is about 13 lbs. Referring to Fig. 3, it will be seen that the back pressure of the gas acts on the check valve, the check valve allowing the water to flow freely toward the generator, but closing whenever the gas pressure tends to force the water back. When the check valve is closed, the water under pressure of the gas acts on the weight valve to lift it. When the pressure is sufficient to lift the weight valve, the gas passes the valve and bubbles up through the water in pipe F, and rises to the top of the auxiliary water tank A. A small tube, having an open end above water, leads from the top of this tank to the escape trap B and from this trap the gas passes through an escape pipe underneath the car into the open air. The water-sealed traps, E E, are used to prevent any back firing of the gas into the auxiliary water tank, due to sparks along the track or burning waste, etc. As the escape traps are filled automatically by the overflow from the auxiliary water tanks, they do not become dry, the water entering the trap in the same manner as the excess gas. The storage tank under the car serves another purpose in tiding over slight intermissions in the gas generation due to any intermittent passing of the water from one carbide basket to another in the generating cartridges.

In case the key valve I should be closed before "after generation" has ceased, provision is made for the excess gas formed. In such a case the gas passes upward through the small pipe P which extends above the auxiliary tank, is curved over and comes down as pipe H. This is simply a loop, high enough to prevent the water in pipe H from siphoning over. As pipe H is joined to pipe G this excess gas is taken care of by the weight valve in the manner just described. When the pressure equals 13 lbs. the gas raises the valve and escapes to the atmosphere through the auxiliary water tank and escape trap E.

The generating cartridges are steel cylinders closed by a top cap and each cartridge contains six baskets placed one above the other. The details of these baskets are given in Fig. 4. In charging the cartridges, 1½ lbs. of carbide are put in each basket, making 9 lbs. of carbide to each cartridge. With this amount of carbide sufficient space is provided for the expansion of the carbide in slacking. The top cap is securely bolted so as to form a tight joint. Referring to Fig. 4, it will be seen that each carbide basket consists of a bowl and a perforated cover. The water in entering the cartridge falls on the solid raised portion at the center of the top cover and then runs off into the surrounding depression. To give a uniform distribution of water on the carbide below, the metal around the perforations is raised ⅛ in., so that the water enters all the holes alike when the depth of water on the cover exceeds ⅛ in. When the carbide in the first basket is slacked, the carbide swells level with a series of side openings just below the cover. Then the water runs through the side holes and down the outside of the upper bowl onto the perforated cover of the next basket. The shape of the bowl is made such that water running down its sides clings to the bowl until it reaches its base, insuring that the water for the second basket is delivered at the center. The water is then distributed over the second perforated cover and sprinkled on the carbide below in the same way as described for the first basket. This process continues until the carbide is slacked in all six baskets; one basket being slacked at a time, beginning at the top.

It is found that one pint of water is required to properly slack 1 lb. of carbide. As there is 1½ lbs. of carbide in each basket, and the baskets are operated on successively, a given amount of water fed from the auxiliary water tank indicates the amount of generation that has taken place in the generating cartridge. The gage D on the auxiliary water tank is therefore divided so that it shows directly whether one or more carbide baskets in the cartridge have received their quota of water for proper slacking. In this way it is always apparent how near a cartridge is exhausted.

The manner of holding the cartridges in the machine is apparent from Fig. 1. The bottom of the cartridge rests on a carrying plate which is raised or lowered by working a ratchet. When the cartridge is in place the carrying plate is raised until the connection between the cartridge neck and the nipple on the frame is tight enough to prevent the escape of gas. The valves I and J cannot be opened until the cartridge is locked in place, these three parts being connected by an interlocking mechanism. First the cartridges must be locked, then valves I I can be opened and then valves J J can be opened, in the order named.

The fact that all the pipes drain into the generating cartridges is considered an important point in keeping the pipes clean. In service no trouble has been experienced from the clogging of pipes. To show this point the pipes of a machine which had been in continuous service for a year were cut open and all were found to be as clean as when they were first put in place.

The acetylene gas light more nearly resembles sunlight than any other artificial light. All decorations retain their true colors and even the most delicate shades are unchanged by the light. As used in the Adlake system a very perfect diffusion is obtained by the use of opal glass globes, the result being a very soft light and a uniform distribution with no high lights and shadows. The effect on the eyes is exceedingly pleasant.

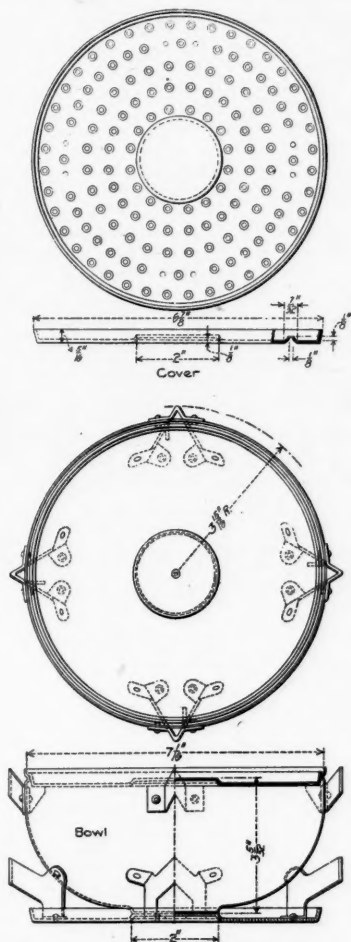


Fig. 4.—Details of Carbide Basket.

is carried in the tank below the car body. At the maximum pressure possible the receiving tank will hold but 10 cu. ft. of gas, which, if let into the car during an accident is but a small proportion of the amount required to form an explosive air mixture. Further, if it were possible to let all the gas which could be generated from the carbide in two cartridges into the body of the car at one time, it is said the quantity of gas would not

Oil Burning Locomotives on the Gulf, Colorado & Santa Fe.

In our issue of Nov. 8 we outlined the progress made in the Southwest in equipping locomotives for burning Texas fuel oil. The discovery in the Beaumont fields of an apparently unlimited supply of oil, well suited for fuel purposes, has naturally started Texas railroads and industrial companies to studying methods of burning oil. Of the railroads in that section the Gulf, Colorado & Santa Fe has made the most progress in equipping locomotives and Mr. T. Paxton, the Master Mechanic, has

kindly furnished drawings and information concerning that road's practice.

The Gulf, Colorado & Santa Fe now has 15 locomotives converted from coal to oil burning and 75 will be converted as soon as the work can be done. For the present, this road will use oil for locomotive fuel as far north as Cleburne, Texas. So far the work has been

somewhat experimental and the details of the plans given here may be modified from time to time as a result of experience.

Fig. 1 shows the arrangement of an eight-wheel locomotive converted to burn oil and in general shows the position of the different parts of the oil apparatus. This arrangement is used quite extensively on the California

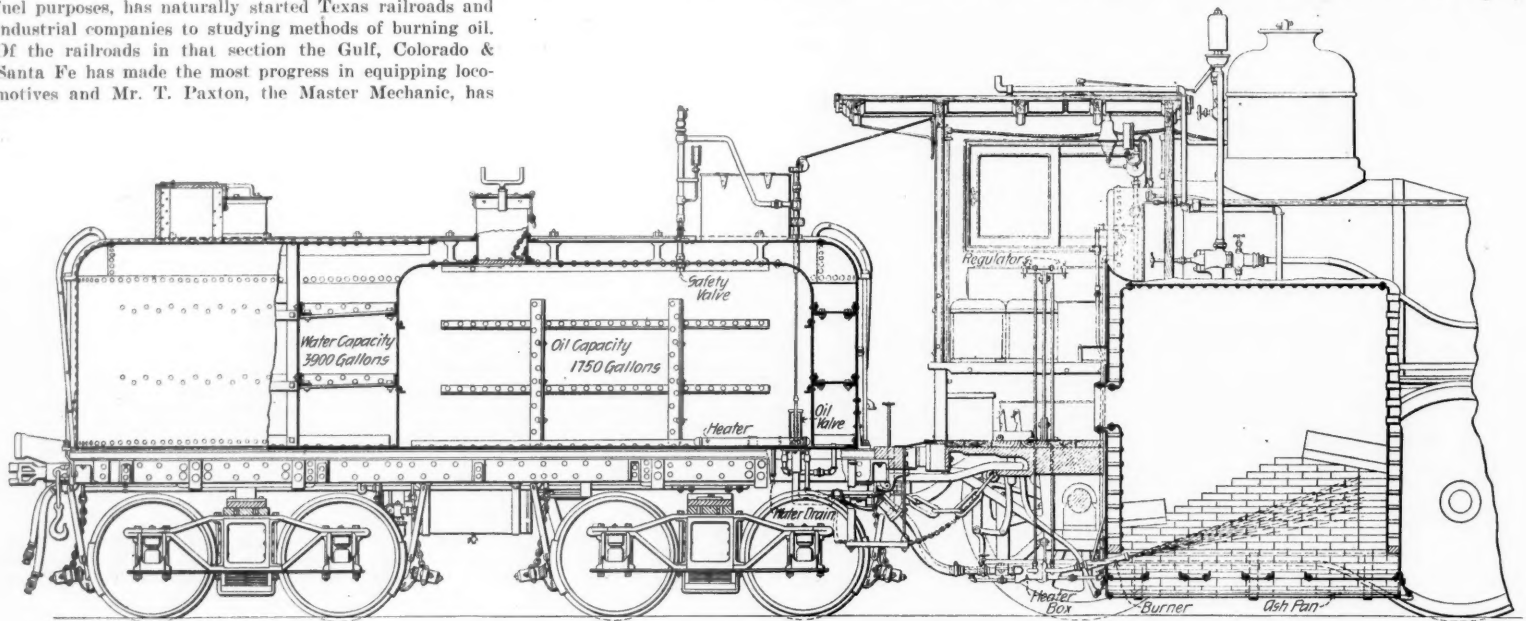


Fig. 1.—General Arrangement of Oil Burning Locomotives—Gulf, Colorado & Santa Fe Railway.

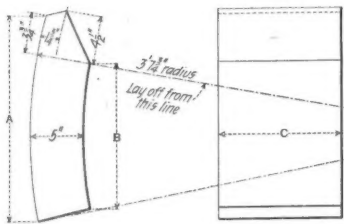
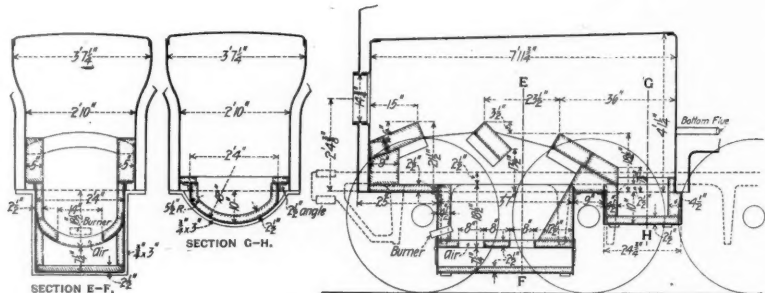
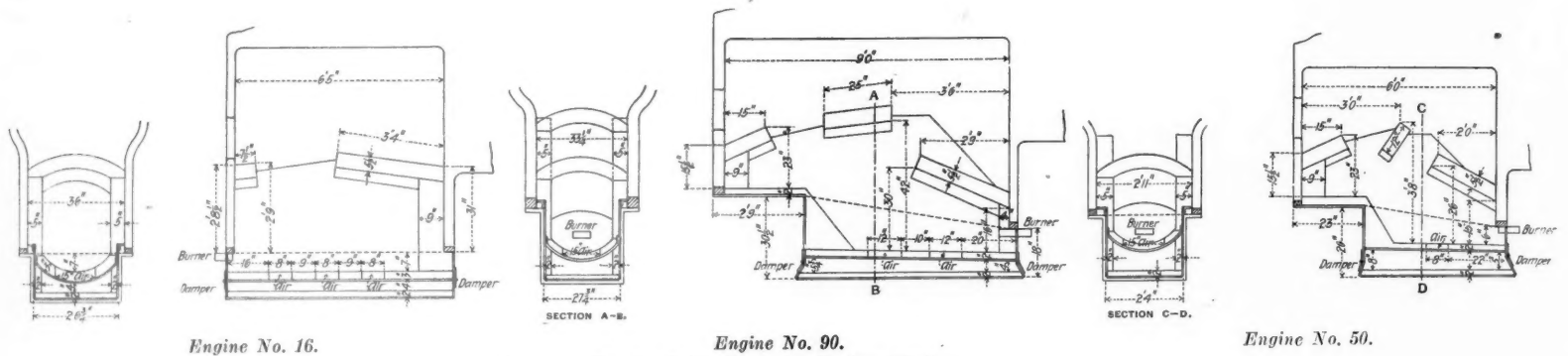


Fig. 2.—Arch Brick for Fire Box of Oil Burning Locomotives.

Number to one set.	A	B	C	For maximum fire-box width of
12	18 1/4"	12 3/4"	7 1/4"	35"
12	17 1/4"	11 3/4"	12"	33"
12	18 1/4"	12 3/4"	12"	35"
12	19 1/4"	13 3/4"	12"	37"
12	22 3/4"	16 3/4"	12"	43"



Engine No. 41.



Engine No. 16.

Engine No. 90.

Engine No. 50.

Fig. 3.—Brick Work for Various Fireboxes.

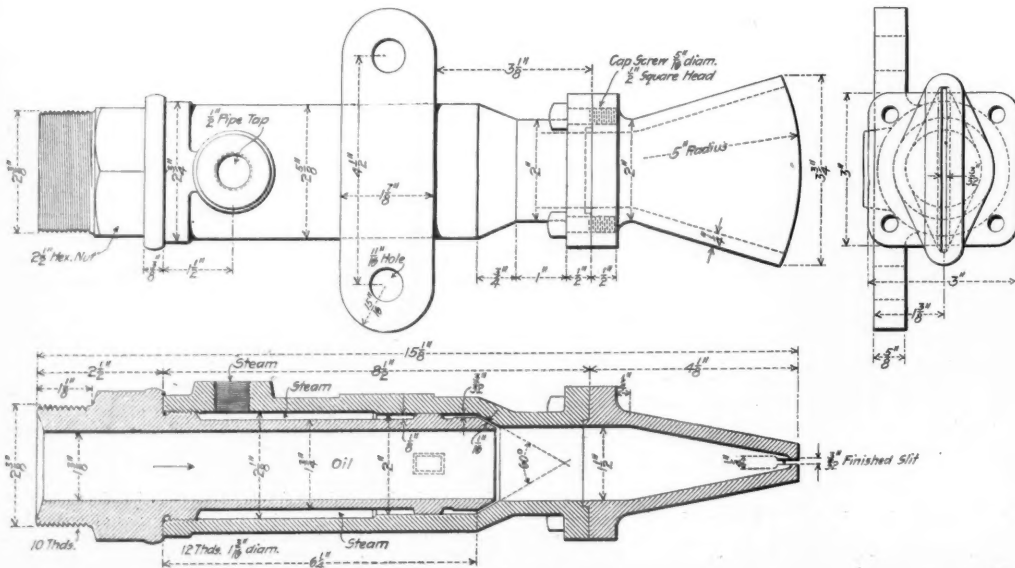


Fig. 4.—Lundholm Fuel Oil Burner.

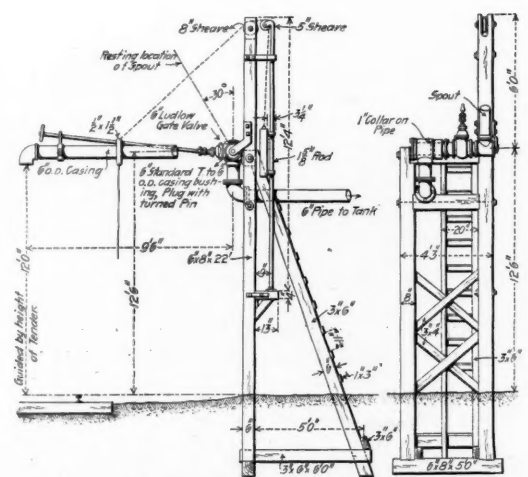


Fig. 9.—Details of Stand Pipe.

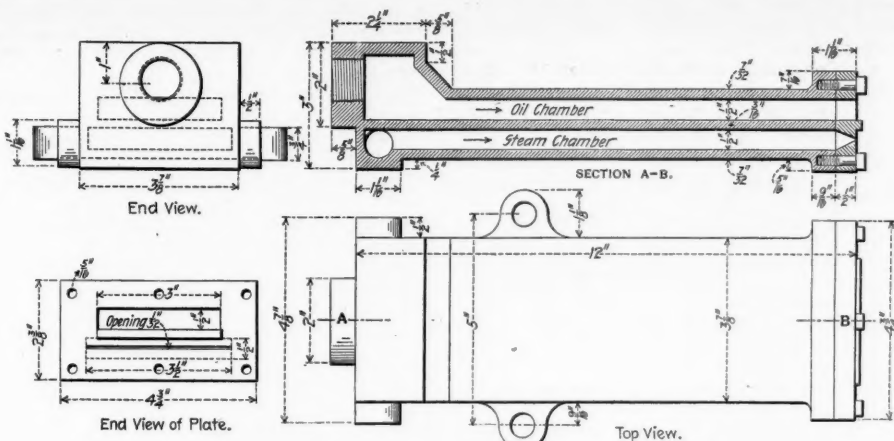


Fig. 5.—Booth Fuel Oil Burner.

Lines of the Santa Fe and is considered the best construction for new work.

The form of the arch brick used in the fire-boxes is shown in Fig. 2, the length of brick being determined by the width of the fire-box. For side walls and the inverted arch, ordinary commercial fire-brick is used. Experience on this road has shown that fire-bricks which soften under heat are preferable, as they form a bond which adds strength to the wall and prevents its shattering under the shocks incident to service. Fire-bricks which have very high heat-resisting qualities and which tend to crack when cooling are said to be of little use in a locomotive burning fuel oil. Fig. 3 shows methods of applying the furnace work to several types of fire-boxes. It will be seen that in all cases the burner is located below the mud ring, the grates are removed and the inverted arch is put in the ash pan. The oil may be introduced at the front or back of the fire-box depending upon the shape of the ash pan.

Two forms of fuel oil burners are being used. The Lundholm burner, Fig. 4, is said to give very good results. The Booth, a patented burner, shown in Fig. 5, is used quite extensively on the California lines of the Santa Fe, but only experimentally on the Gulf, Colorado & Santa Fe. The operation of these burners is apparent from the drawings. The Booth oil safety valve, which controls the discharge of oil at the bottom of the tank,

is shown in Figs. 6 and 1. The valve is opened by a bell cord running into the cab and is closed automatically in case the engine breaks away from the tender.

The method of applying oil tanks to passenger and freight tenders previously used for coal is shown by Fig. 7. On passenger locomotives the oil tanks hold 1,850 gals. and on freight engines from 2,000 to 2,200 gals., according to the size of the locomotive. A tank is placed in the coal pit and is coupled through suitable rings and gaskets to a large flat tank which lies on top of the tender. The oil tanks can easily be removed in case it is desired to return to the use of coal. In switching service the oil tanks contain 1,000 gals. The tank is then made to fill the coal pit and it projects high enough to give the required capacity in a single tank without blocking the sides of the tender or interfering with the view of the enginemen.

For discharging oil from the tanks to the burner, air pressure not exceeding 10 lbs. is used. Steam is used as a vaporizer, combining the steam with the oil in the burner. In localities where low temperatures prevail, or where the oil lacks fluidity, it is found desirable to interpose a heater box between the burner and the oil tank, in which the oil is raised to as high a temperature as possible with steam before it goes to the burner. However, the high fluidity of the Beaumont oils, the small effect on the oil of low temperatures and the location of

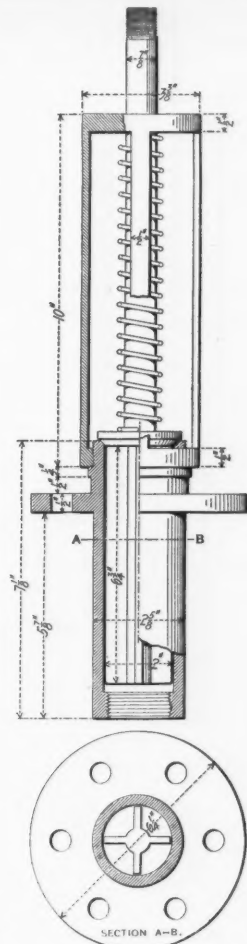


Fig. 6.—Booth Fuel Oil Safety Valve.

the road in the South, render the heater box less of a necessity on the Gulf, Colorado & Santa Fe than would usually be the case.

For supplying the locomotive tanks with oil, delivery tanks and stand pipes are erected as shown by Figs. 8 and 9. The oil is furnished to these delivery tanks from large storage tanks of 37,000 bbls. capacity.

On the Gulf, Colorado & Santa Fe, with present prices of coal, there is a saving of from 25 to 40 per cent. by the use of fuel oil. The lower figure applies near the source of the road's coal supply while the larger saving is in the vicinity of the oil fields, the cost of transporting the fuel being a determining factor in both cases. Other important economies following the use of oil which can only be estimated are: Avoiding all claims for damage by fires set by locomotives; the reduction of clinker pit expense, and greater expedition in handling locomotives at terminals. Other advantages follow the use of oil fuel, such as: Freer steaming and freer running locomotives and consequently greater ability to handle maximum loads; a uniform grade of fuel makes it practicable to adjust draft appliances to get the best results under all conditions; owing to the easy and exact regulation of the fire possible with oil there is a further economy as the labor of firing coal conduces to extravagance in its use.

Mr. Paxton points out that an important point to be observed by firemen on oil-burning locomotives is to so regulate the rate of combustion as to avoid overheating the fire-box plates. It is possible, in firing with crude oil, to burn off projecting rivet and crown bolt heads as the heat may be made so intense that radiation through the plate does not carry it away fast enough to protect the sheets. In localities where the feed water contains impurities which form hard scale on the plates, this trouble is augmented owing to the lower conductivity of the scaled plates. It is of less importance where the water is so soft that the fire-box plates are always clean. This is a thing, however, which is wholly under the control of the fireman and if care is taken there should not be serious trouble.

Other points are covered in a circular of instructions issued to each engineman and fireman in charge of an oil-burning locomotive, and these instructions are also posted in the cab of each engine using fuel oil. The instructions are as follows:

INSTRUCTIONS GOVERNING THE HANDLING OF OIL-BURNING ENGINES, AND THEIR REPAIRS.

Do not approach a man-hole or vent-holes of tank with a lighted torch or lantern closer than ten feet.

Do not take a lighted torch or lantern to a man-hole to ascertain the amount of oil in the tank, but this must be ascertained with a stick or rod; it to be carried to a light to ascertain the number of inches of oil on the stick or rod.

Do not, when making repairs or inspection of an empty tank, place a lighted lamp or torch inside before the tank has been thoroughly steamed and washed out, as gas will accumulate in an empty tank not so steamed and washed out and explosion is liable. Employees are positively prohibited from entering tanks having contained crude oil, until the instructions to thoroughly steam and wash them out have been complied with.

Do not, in firing up, apply atomizer and oil before putting in the lighted waste, as gas may accumulate in the fire-box and cause an explosion.

In starting up or stopping, the engineer must always notify

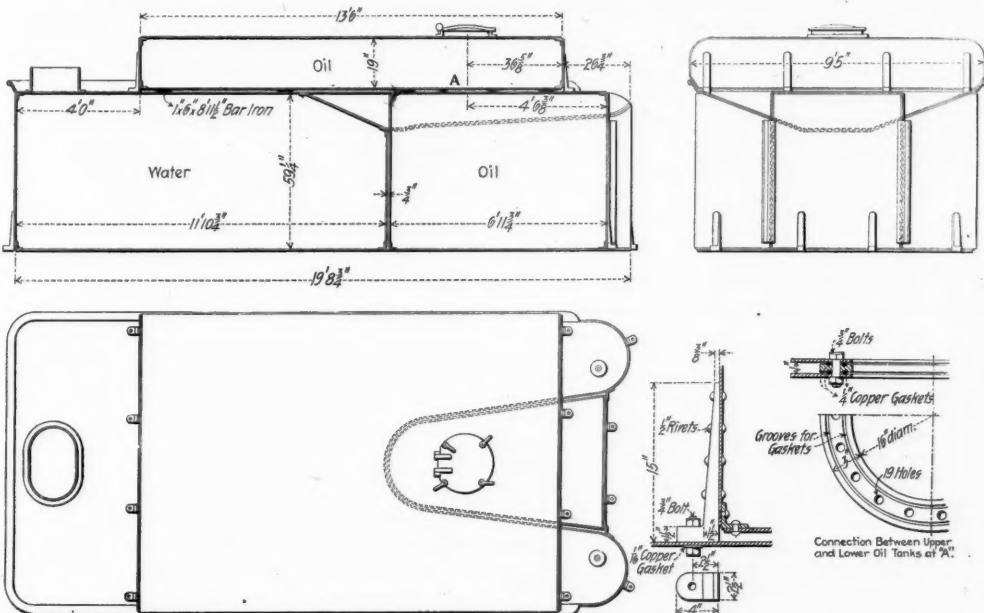


Fig. 7.—Application of Oil Tanks to Standard 5,000 Gallon Tenders.

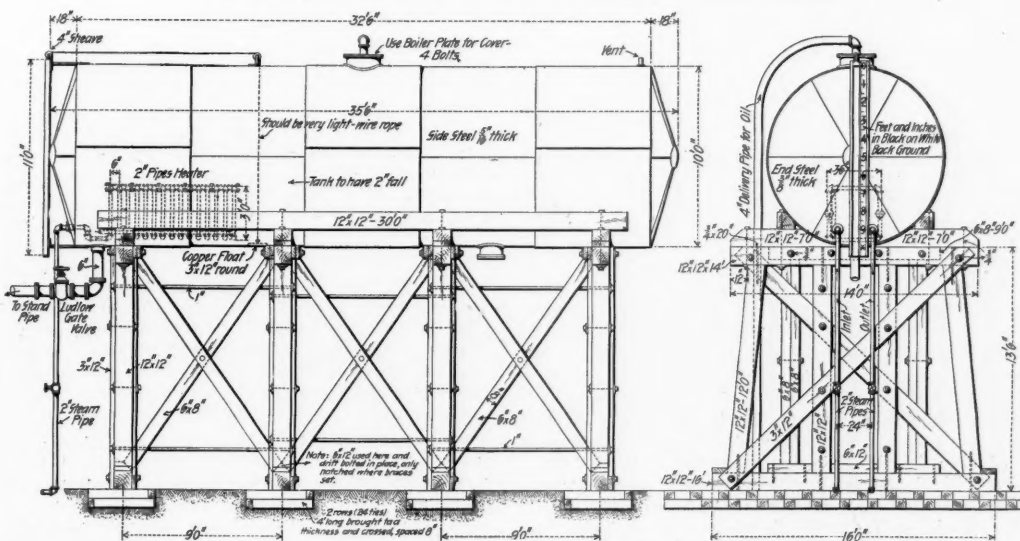


Fig. 8.—Fuel Oil Delivery Tank.

the fireman, as the starting or shutting off of the fire must in all cases precede the opening and shutting off of the engine. Do not force the firing. Bring the fire-box temperature up gradually. If the pressure falls back five or ten pounds, restore the maximum pressure by gradual degrees. Forced firing will overheat the plates, burn off rivet heads, and cause leaks.

In sanding the flues to clean out the accumulation of soot and gum, drop the lever to half-stroke, and use full throttle for a few turns, while sand is being injected.

Successful combustion of petroleum is smokeless. An accurate combination of steam and oil in the atomizer and air admission is necessary to thorough combustion. To this end adjust the steam and oil valves and dampers closely.

Always remember that petroleum contains a greater or less percent. of volatile gases, which are given off at low temperature. Hence in no cases should torches, lamps or lanterns be taken in or near about tanks containing this substance.

In firing up in the roundhouse where steam is available as an atomizer, connection is made to the three-way cock on the smoke arch, which acts as a blower and atomizer at the same time. Drop a bunch of lighted waste in front of the burner in firing up in the roundhouse, then lightly turn on the atomizer and oil. Watch the fire until steam begins to generate. Then steam for the remainder of the process can be used from the engine, and the roundhouse steam line can be cut off. Sometimes for various reasons, the fire may go out when started in a cold engine. If this is not noticed at once, the oil running in the pit may take fire later on and explode or do damage to the engine. Hence it should be watched until you are sure it is all right.

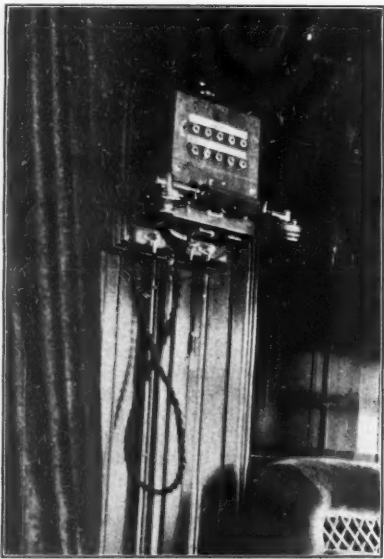
Where a steam line is not available in the roundhouse in firing up, wood may be used until ten or fifteen pounds of steam is generated. The wood must be put in the furnace with extreme care to avoid damaging the brick work, and in starting out with an engine fired up with wood, care must be exercised to prevent wood sparks setting fires along the right-of-way.

Should it become necessary to do any work inside of the oil tanks after they are empty, they must first be steamed and then washed out with cold water, before a lighted torch of any kind is taken near the opening. This is to insure a cleansing of the tanks of all gases they may contain. Employees are positively prohibited from entering tanks having contained crude oil, until the instructions to thoroughly steam and wash them out have been complied with. Leaks in the tanks or connections should not be permitted.

Telephones On the Duke of York's Train.

The reader is already familiar with the fact that the palatial train which was provided by the Canadian Pacific for the Duke of Cornwall and York on his recent visit to Canada was equipped with telephones for communicating from car to car. An officer of the railroad company informs us that these telephones worked with perfect satisfaction. The following description of the installation is from notes given to us by President C. F. Sise, of the Bell Telephone Company, of Canada:

The train consisted of nine cars, the two first being baggage cars, one a diner and the rest sleeping and special cars. Telephone sets were installed in all the cars except the first baggage car. No set was installed on the engine. This would hardly have been practicable, for while the train remained intact for practically the whole journey, the engines were changed at the usual points. The telephone sets were specially designed for this train, the cases being of the same wood and finish as the interior of the cars, one being of oak, one of prima vera and the rest of mahogany. Eight sets were provided, one for each car. The cases are about 6 in. x 10 in., the faces being equipped with a number of sockets, each one marked



Telephone on Canadian Pacific Royal Train.

with the name of one of the other cars. A plug which fits them is attached by means of a flexible cord to the side of the box, while a push button is located above the sockets with a vibrating bell on the top of all. To communicate with any car the plug is inserted in the socket marked with the name of the car wanted and a button is depressed; this sends a signal, power being derived from a battery of dry cells placed about the middle of the train. For talking, special combination telephones and transmitters are provided. If a transmitter were attached to the car in any way, the vibration of the train would disturb the transmitter, causing such a noise in the telephone as to make conversation next to impossible. In these combination sets the telephone and the transmitter are joined together. When the telephone is taken from the hook, the transmitter, being joined to it, is also removed. When the telephone is held to the ear the transmitter mouthpiece, which is curved, is at a convenient distance from the lips. By removing the transmitter from all connection with the body of the car the noise due to vibration is reduced to a minimum and talking is good.

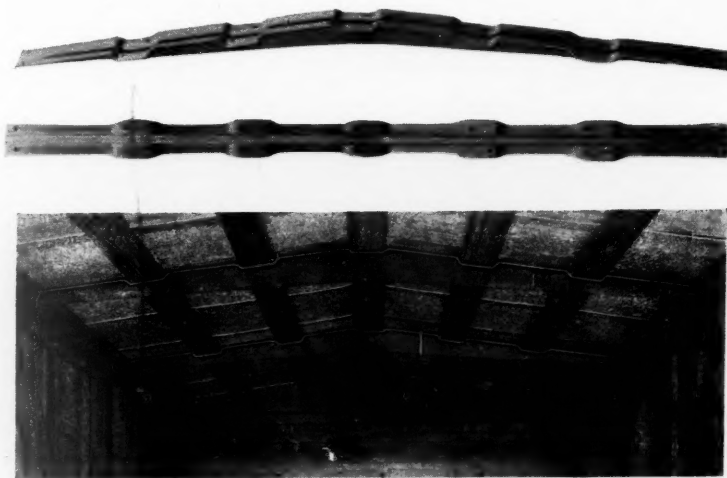
The cars are wired with rubber covered wire cable run underneath the car. Under each platform is a brass case in which are placed insulated sockets, or "jacks," one for each line. The cars were connected by flexible cables of rubber-covered wire, provided with a case of plugs at each end (the plugs being insulated from the case). These plugs fit the sockets under the cars. The two cases of plugs are also connected by a chain so that if the cars should break apart the plugs would be pulled out of the sockets without damaging the connecting table.

The telephone sets were made by the Northern Electric & Mfg. Co., of Montreal, and the installation was done by the Bell Telephone Company, of Canada, Ltd.

Pressed Steel Carline—Pere Marquette Railroad.

One page 672, Sept. 27, we gave an illustrated description of this carline as designed by Mr. B. Haskell, Superintendent of Motive Power of the Pere Marquette Railroad. The patents are controlled by the American Car & Foundry Co.

One of the 500 38-ft. wooden box cars of the Pere Marquette, having these steel carlines was recently tested to ascertain if any permanent set would be given to the carlines if a reasonably heavy load were put on the roof.



Pressed Steel Carline—Pere Marquette Railroad.

Seven and one-half tons of pig iron was evenly distributed on the running board of a car from end to end, the deflection being $\frac{3}{8}$ in. in carlines. This load was allowed to remain a few hours and was then removed, when it was found that the carline had not taken any permanent set. A load of $7\frac{1}{2}$ tons is more than any car roof will have to sustain. This load would represent on the inside of the car an outward pressure at the side plates of over 15 tons and it is fair to presume that a load as great as this will never be brought to bear on the inside of a car up as high as the side plates. The accompanying illustrations are from photographs of a carline, and the interior of a box car fitted with the steel carlines.

The expense of the steel carlines as applied to these cars is the same, all points considered, as the present form of wood construction, because in a 36-ft. or 38-ft. car but seven steel carlines are required, instead of 11 or 13 wood carlines with the necessary cross-tie rods. On the 38-ft. car a gain of 54 cu. ft. of space was made by the use of the pressed steel carlines. If the standard box car dimensions are adopted, as recommended by the American Railway Association at their recent meeting (36 ft. long, 8 ft. 6 in. wide and 8 ft. high, inside measurement) the eave height would be 12 ft. 6 in. with wood carlines, whereas with the steel carline (the inside height being maintained) the eave height would be 12 ft. 4 in. This is a decided advantage to the railroad companies, as the car siding can be cut from 18-ft. lengths, while if the wood carline is used, siding will have to be cut from 20-ft. lengths.

Meeting of the Naval Architects and Marine Engineers.

(Continued from page 802.)

time, when it becomes necessary, is a matter of great consequence.

There is much difference of opinion in regard to the range at which the modern gun is effective. . . . My impression is that those who have witnessed a good deal of firing from guns in coast fortifications think that a ship would be in great danger from the guns of a fort in direct fire at 8,000 or 9,000 yards, and I assume that this presupposes that the range is accurately known, as it usually may be in a fort. I should think, however, that so great accuracy would be attained only when the firing is very deliberate, and when such elements as the muzzle velocity due to the powder in use are accurately known. In a ship gun, where the range is rarely accurately known, and where the ship is usually moving, accurate practice cannot be made at so great a distance as 8,000 yds. I think that most naval officers believe that with their guns, and in reasonably smooth water, they can make fair practice at 3,000 or 4,000 yards. My own belief is that this is too great an estimate. At 3,000 yards range a target 15 ft. high, when a gun is rolling at an angular rate of 1 deg. per second, which is

a fair rate only, the prolongation of the line of sight of the gun would sweep across the freeboard of a ship 15 ft. high, which would include all the vulnerable part of the ship, in somewhat less than one-tenth of a second. This is a period of time too small to be appreciated by a man's nerves, and, indeed, the accuracy of operation of the firing apparatus of the gun can hardly come within this limit.

A word may now be said in regard to the improvements in the quality of steel in guns, and whatever is said about this may apply, it is obvious, to shafting. Ten or 12 years since, or thereabouts, the tube of a large gun or a large piece of shafting which showed 40,000 lbs. elastic strength was considered something rather out of the common; nowadays it is not at all unusual to be able to secure 60,000 lbs. elastic strength in the same forging. This could be attained with about 16 per cent. elongation. Indeed, up to guns of about 5-in. caliber, qualities as high as 70,000 lbs. elastic strength, with 16 per cent. elongation, and about 130,000 ultimate strength, have been reached at Bethlehem. Nor is there any reason to anticipate that this material is any less safe to use than the softer material. Indeed, all the evidence goes the other way. It would not, perhaps, be desirable to reduce a gun's thickness of wall very materially in case this stronger material is used, but rather to consider the

gained strength as so much surety against disastrous accident. Indeed, it would be impossible to materially reduce the weights of guns without increasing that of their carriages, as with a lighter gun the recoil would become much more violent and harder to control. . . .

When we come to what may be called the tactical aspects of guns and armor, we find also material changes. . . . If battleships are to penetrate each other they must approach within 1,000 yards range in combat. This brings us back to the fighting range of old wooden ships, very nearly, for they had to approach within about 600 or 700 yards; and, when you consider that a battleship's 6-in. guns must have normal impact to perforate the armor protecting the 6-in. guns of their opponents at 800 or 1,000 yards, it may be said that the fighting range of ships has not so very materially altered in the past hundred years. . . .

Finally, in closing, I want to bring forward, in order to more definitely determine the coming range of naval combat, the fact that there is one of its ruling factors which remains constant for all time. This is, the accuracy and delicacy of the firer's eyes and nerves. If a man can appreciate four intervals in a second, and if the firing apparatus put into his hands is instantaneous in action, he can hit a ship 15 ft. high, at a range of about 1,000 yards, when his own gun is swinging, in rolling, at an angular rate of 1 deg. per second. This consideration, of course, remains fixed for all time.

THEORETICAL AND PRACTICAL METHODS OF BALANCING MARINE ENGINES.—BY NAVAL CONSTRUCTOR D. W. TAYLOR, U. S. N.

Some years ago, Mr. Yarrow made some experiments on torpedo-boat vibrations, in the course of which he ran a boat under way and determined the nature and extent of the vibration. He then removed the propeller and ran the boat alongside the dock, determining again the nature and extent of the vibration. The result was that, for a given number of revolutions of the engines, there was very little difference between the vibration under way and the vibration alongside the dock with the propeller removed. The correct inference was that in this case the propeller had little or no tendency to cause vibration. This, however, was for a torpedo boat with fine lines, a fine run, and a very carefully balanced propeller. . . .

The state of the science is now such that, given an engine, it is possible to determine fully the unbalanced forces developed from it at any number of revolutions. In theory it is possible to balance perfectly any engine. In practice, however, so many weighty considerations, apart from those of balancing, must be taken account of that the design of correctly and satisfactorily balanced en-

gines, which are satisfactory in other respects, is exceedingly difficult.

Let us consider first an engine with a single cylinder. If steam is in the cylinder, but the piston is not moving, the pressure upon the piston and the pressure upon the cylinder head are equal and opposite. These pressures neutralize one another through the engine framing, and there is no external or unbalanced force communicated to the engine supports. If, however, the piston, with its attached weights, is moving and being accelerated, that portion of the steam pressure necessary to accelerate it is absorbed in giving energy to the moving parts, and hence is not transmitted to the engine framing. It follows that the pressure on the cylinder head which tends to move the framing in one direction is only partially balanced by that portion of the steam pressure upon the piston which is transmitted to the engine framing via the piston rod, connecting rod and crank shaft. It is obvious, then, that the unbalanced forces developed when a single cylinder engine is revolving are equal and opposite to the forces necessary to accelerate or retard the moving parts as the engine turns over.

I come now to the question of balancing engines so as to reduce or extinguish entirely unbalanced forces. The methods previously explained will always enable us to determine whether or not an engine is balanced, and modifications of them will be found very useful when searching for methods to obtain a balance. I shall consider, primarily, the usual type of marine engine, the "vertical inverted," where the cylinders are arranged in line above the shaft. There are four conditions which must be fulfilled in a perfectly-balanced engine.

1. As it revolves the combined center of gravity of the moving reciprocating weights must remain at a constant distance from the axis. When this is the case, there can obviously be no resultant inertia forces, and hence no external force caused by the motion of the reciprocating weights.

2. If we substitute for each moving reciprocating weight another one proportional to the product of the weight by its distance parallel to the shaft from a fixed point on the shaft axis, the center of gravity of this derived system of weights must remain at a constant distance from the axis as the shaft revolves. When this is the case and the first condition is complied with, there can be no external couple due to reciprocating weights.

3. The center of gravity of all revolving weights must be in the shaft axis. When this is the case, there can be no external force due to revolving weights.

4. If for each revolving weight we substitute a weight proportional to the revolving weight, multiplied by its distance parallel to the shaft from a fixed point on the shaft axis, the center of gravity of this derived system must be in the shaft axis. When this is the case and the third condition is complied with, there can be no couple or moment from revolving weights.

The above essential conditions for perfect balance have been known for years. It is evident that if all the force and moment polygons are closed the four conditions are fulfilled—otherwise, they are not fulfilled. It is evident, too, that if the four conditions are fulfilled for uniform rotation, they are necessarily fulfilled for non-uniform rotation.

It will be noted that I have throughout made a marked distinction between the reciprocating and the revolving weights. This is because forces and moments due to reciprocating weights are constant in direction, remaining always in the plane of the cylinder axis, and vary in magnitude as the shaft revolves. The forces and moments due to revolving weights, on the other hand, are constant in amount, but vary in direction as the shaft revolves. The components of the revolving forces and moments, resolved parallel to any one direction (say the plane of the cylinder axes), are variable in amount, because the constant forces and moments are variable in direction.

It is quite possible to balance the forces and moments of reciprocating weights by the components parallel to the plane of the cylinder axes due to revolving weights, but this renders it impossible to balance the forces and moments of the revolving weights perpendicular to the plane of the cylinder axes. If reciprocating weights are balanced by revolving weights, the latter must have unbalanced resultant components in the plane of the cylinder axes equal and opposite to the unbalanced resultants of the reciprocating weights. But then the unbalanced resultants of the revolving weights in the direction perpendicular to the plane of the cylinder axes are equally great, and in this plane there is nothing to oppose or balance them. . . . It is clearly logical and satisfactory to attack the problem in detail—balance reciprocating weights by reciprocating weights only, and revolving weights by revolving weights only.

The more numerous the cranks of an engine the more readily it can be balanced without using special balance weights, which should be avoided where practicable. Also, for an engine of given power and revolutions per minute, the more numerous the cylinders the lighter the moving parts of the individual cylinders. . . . After making due allowance for the fact that the engines develop different powers at different revolutions, the ameliorating effect, as regards vibrations, of increase in the number of cylinders is obvious.

I shall proceed now to discuss the question of balancing ordinary vertical inverted engines of one, two, three, four and five cranks. As a rule, there is one cylinder to each

crank, and this is assumed to be the case unless otherwise stated. Main weights only will be considered at first.

With one cylinder there are no unbalanced moments, and partial or complete balance cannot be obtained by judicious arrangement of moving parts of several cylinders. It is possible to balance the primary reciprocating forces by introducing large revolving weights, but the strong objections to this course have already been pointed out. It is, however, practicable to balance completely the revolving weights by weights on the shaft opposite the crank pin, and this should always be done. If it is then required to balance the reciprocating weights, the most practicable method is to use lever driven balance weights. The introduction of such a weight evidently results in an unbalanced couple. If this must be avoided, two weights may be used. . . . The small use now made of single-cylinder engines for marine purposes renders the question of the balance of such engines one of little practical importance.

It is entirely impossible to close either force or moment polygons of two crank engines without introducing other sides, i. e., with the two-cylinder engine as usually arranged bob weights must be used to improve the balance. But these must be driven by cranks or their equivalents—eccentrics—resulting in an engine with more than two cranks.

It is probably the best practice, if two-crank engines must be balanced, to secure revolving balance by balance weights opposite each crank, and then for reciprocating balance use lever balance weights for each cylinder, as in the case of a single-cylinder engine. There are special arrangements, however, for two-cylinder engines, which secure perfect balance, though the usual arrangement of two cranks at 90 degrees must then be departed from.

A two-cylinder arrangement has recently been brought forward by MacAlpine, which eliminates secondary forces.

It is, however, a simple and elegant solution of the problem of complete two-cylinder balance, and by doubling it, i. e., using two pairs of cylinders on one shaft, it can be applied to triple and quadruple expansion engines.

For three-crank engines the force polygons are three-sided figures and the moment polygons two-sided figures. We have now reached a sufficient number of cranks to allow reduction of unbalanced forces by properly choosing reciprocating weights and crank angles. Also, in these days of triple expansion, all marine engines of importance have at least three cylinders, so the three-crank case is the first one I have discussed of practical importance.

The moment polygons—two-sided figures—obviously cannot be closed by variation of weight and crank angles. The force polygons are, however, three-sided figures, and as long as any two of the reciprocating weights are together greater than the third the primary force polygon can be made a closed triangle by adopting proper crank angles. The condition that two weights must be greater than the third allows a wide choice of reciprocating weights and crank angles, and we should make a choice which will, if possible—

1. Secure balance of secondary as well as primary forces.
2. Be desirable, or at least not objectionable, as regards the very many considerations other than vibration affecting engine design.

Now if all the reciprocating weights are made equal, and the three cranks set at 120 degrees, we find that—

1. The primary force polygon is a closed equilateral triangle.
2. The secondary force polygon is also a closed equilateral triangle.
3. The crank angles are those fixed upon by common consent as the most desirable from the many considerations other than those of balancing.

If it is desired to secure reciprocating weight balance as regards moments for three-crank engines, the most feasible plan is to introduce reciprocating balance weights at the ends of the engine driven by cranks or eccentrics. Such an arrangement, however, is in the four or five crank class.

Considering now revolving weights, it is obvious that if the revolving weight on each crank is equal (cranks being at 120 degrees), forces are completely balanced, while there is left an unbalanced revolving moment, which is, from the nature of the case, smaller than the unbalanced reciprocating moment. For this reason it is not necessary, as a rule, to attempt further revolving balance in a three-crank engine with cranks at 120 degrees and equal revolving weights on the cranks, which is, by the way, the usual arrangement, all three cranks and connecting rods being made the same. If complete revolving balance is aimed at, however, for moments as well as forces, the most feasible method is to counterbalance separately the revolving weight on each crank. Or the methods of revolving balance described in discussing four-crank engines may be applied.

For three-crank engines in practice the nearest approach to balance is obtained by adopting cranks at 120 degrees and making the reciprocating and revolving weights for each crank the same. A slightly better balance may be obtained by fully balancing with counterweights the revolving weights for each crank, thus extinguishing revolving moments; but as reciprocating moments, which are usually larger than the revolving moments, are necessarily left unbalanced, it appears hardly

worth while, as a rule, to add weight, complication and expense to a three-crank engine for the purpose of avoiding revolving moments.

For a four-crank engine the force polygons are four-sided figures and the moment polygons three-sided figures. Evidently, then, the "balancing possibilities," so to speak, in the case of a four-crank engine, are decidedly superior to those of engines previously considered. The large and increasing use, of late years, of triple-expansion engines with two L-P. cylinders, and of quadruple expansion engines, has, through the use of four cranks, increased the opportunities for balancing and the development of balanced types of engines. Progress in marine engine balance during the last ten years has been made almost entirely with four-crank engines. It is necessary, then, to consider most thoroughly the balancing possibilities and limitations of such engines.

Before beginning this task, I desire to call attention to the important fact that the usual spacing of cranks of 90 degrees, found in the case of four-crank engines, is essentially inferior as regards uniformity of turning moments.

If a four-crank engine has four simple, double-acting cylinders, the 90 degree spacing is equivalent, as regards turning moment, to two cranks at 90 degrees. . . . To secure the most uniform turning moment for double-acting engines, the crank should be at or opposite the angles obtained by dividing 180 degrees, not 360 degrees, by 4, the number of cranks. Thus, starting with the first crank at 0 degrees, the second should be at 45 degrees, or 225 degrees; the third at 90 degrees, or 270 degrees; and the fourth at 135 degrees, or 315 degrees. This conclusion, obvious for four-crank simple engines, is readily shown to apply to quadruple engines, where about the same power is developed in each cylinder. We shall see later that the crank angles for four-crank engines, which it is necessary to adopt for balancing, approximate fairly closely to those most favorable for uniform turning, so that a balanced four-crank engine is also one with a more uniform turning moment than if the 90-degree crank spacing is adopted.

It may be asked why, in a three-crank engine, cranks equally spaced around the whole circumference give the best turning moment. The answer is that (since in a double-acting engine the turning moment of a crank is equivalent to that of a crank directly opposite) the usual three-crank arrangement at 0 degrees, 120 degrees and 240 degrees is equivalent to one at 0 degrees, 120 degrees and 60 degrees, and in the latter the cranks are equally spaced over the first 180 degrees of the crank circle. . . .

With a four-crank engine, balanced as regards the reciprocating weights, there are so many ways of obtaining revolving balance that it becomes a question of selecting that one having most practical advantages as regards simplicity and cheapness. The ideal method as regards balance alone is to fit proper counterbalance weights opposite each crank. If, however, the revolving force and moment polygons are plotted, it will be found that equally complete balance can be secured with less total addition of weight. If moments are taken about the after crank as usual, a revolving weight at the forward crank at a suitable angle will close the revolving moment polygon. This will, of course, mean an additional side to the revolving force polygon, but the latter can now be closed by a suitable weight at the proper angle at the after crank. In practice it is not convenient, as a rule, to apply balance weights at the cranks, unless they are on or opposite to the crank. So the most feasible plan in practice is to fit two revolving counterbalance weights, one aft of the engine framing and the other forward. The turning wheel can usually be made use of for the attachment of one of these weights, and if the forward end of the shaft is extended two or three inches, a wheel or disk for a forward balance weight is readily attached. Once the correct force and moment polygons are plotted, the amounts and angles of these weights are readily determined.

Before finally balancing revolving weights it is well to take advantage of any obvious methods for reducing the unbalanced resultants. This may often be done, for instance, by drilling holes in one or more solid crank pins, or filling one or more, when they are hollow, with lead or similar devices.

It is not necessary to enter into a detailed analysis of the case of five-crank engines. With them perfect balance can be secured in a very simple manner.

Foreign Railroad Notes.

A horse car conductor in Vienna got into a row with a passenger who called him names and shook his stick at him. Whereupon the passenger was prosecuted for abusing an official. The court said it was lucky for the man that the car was drawn by horses. If it had been a steam or electric car the conductor would have been an official; but that quality does not attach to a horse car employee.

The French government has granted a charter for a railroad from Kotonu, in Dahomey, Africa, northward about 200 miles, to Georges Borelli, of a well known firm of West African merchants, of Nantes, France. The colony has already nearly completed 60 miles of the grading. The road is to be of meter gage. A subsidy of \$610 per mile is granted for eight years, and also a land grant. Materials and fuel for this railroad will be admitted free of duty; which may be of interest to some on this side of the Atlantic.



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CONTRIBUTIONS—Subscribers and others will materially assist us in making our news accurate and complete if they will send us early information of events which take place under their observation, such as changes in railroad officers, organizations and changes of companies in their management, particulars as to the business of the letting, progress and completion of contracts for new works or important improvements of old ones, experiments in the construction of roads and machinery and railroads, and suggestions as to its improvement. Discussion of subjects pertaining to ALL DEPARTMENTS of railroad business by men practically acquainted with them are especially desired. Officers will oblige us by forwarding early copies of notices of meetings, elections, appointments, and especially annual reports, some notice of all of which will be published.

ADVERTISEMENTS—We wish it distinctly understood that we will entertain no proposition to publish anything in this journal for pay, EXCEPT IN THE ADVERTISING COLUMNS. We give in our editorial columns OUR OWN opinions, and these only, and in our news columns present only such matter as we consider interesting and important to our readers. Those who wish to recommend their inventions, machinery, supplies, financial schemes, etc., to our readers, can do so fully in our advertising columns, but it is useless to ask us to recommend them editorially either for money or in consideration of advertising patronage.

The Isthmian Canal Commissioners met in Washington last week and closed up their report. The daily newspaper reporters have said many times recently that the report will definitely eliminate the Panama route from consideration. We suppose that such statements are mostly guesses made by piecing together irresponsible statements, and it is not safe to assume that they are correct. Whatever happens we hope that the Commission will have made a unanimous report, and that its recommendations will be so clear-cut and unqualified as to remove doubts and misapprehensions from the mind of the public. Meantime, the treaty with Great Britain has been signed and newspaper writers on both sides of the water claim to know that it abrogates the Clayton-Bulwer Treaty; leaves to the United States alone the duty of maintaining the neutrality of the canal; gives to the United States the privilege of fortifying the canal, and provides that the canal may be closed by the United States against powers at war with the United States. Furthermore it is said that the treaty provides that there shall be no discriminating tolls or charges in favor of United States shipping. Apparently these main facts are fairly accurately guessed at by the newspaper writers. At any rate they do not sound improbable. Putting this and that together, it seems as if there were great chances of a definite canal bill to be passed this winter, and as if construction would be speedily begun. If the nation is committed to this enterprise we must be prepared for two results. First, if the provisions of the treaty are as stated above, we must be prepared to take care of a new and remote part of our coast line and that means that we must greatly strengthen our navy. Second, we must be prepared for the effects upon industry and trade which will follow from locking up a great sum of money where it can produce no return for many years to come; hundreds of millions of dollars cannot be spent in unproductive work and leave no effect behind. The case is not at all comparable with the recent financing of enormous concerns in this country. There energy, as represented by labor and material and money, has not been poured into unproductive work.

Per Diem Car Service.

There appears to be a first-rate fighting chance that the proposition to use the per diem instead of the mileage basis for freight-car-hire will be adopted at the next meeting of the American Railway Association (New York, April 23, 1902). This is the strongest statement of the situation that we feel

justified in making at this time, though a number of newspapers, after interviewing various railroad presidents and managers, whose names they do not give, speak with more confidence. But even a hope is a substantial ground for congratulation, if it is well founded, for the need of reform is great, and the hope has been long deferred.

Everybody who cares, and who has his eyes open, has for years fully understood all about the unbusinesslike and extremely wasteful conditions which now prevail, in the matter of settlement for interchanged cars, and there has been no question what ought to be done nor much question about the way to do it; but the courage to tackle the problem appeared to be lacking, and most of the friends of the reform have found nothing to do about it but to sit and wait.

The problems which will have to be met and solved are not essentially different from what they were a dozen years ago, when the American Railway Association last tried to establish per diem; except that the railroads are now collecting demurrage from consignees at a good many places. The fact that the cost of excessive delay at terminals will not have to be wholly borne by the railroad ought to make it easier to induce terminal railroads to pay for borrowed cars by the day. This will be an advantage. There is, perhaps, some disadvantage, as compared with 1888, in the great variety of sizes and capacities of cars now in use; but that element will be no worse under per diem than under a mileage basis. The principal difficult questions are unchanged. A short delivering road will have to pay more than it now does for borrowed cars, and will have to demand a larger proportion of the revenue on long-distance joint-freight. An intermediate road, favorably situated, can get thousands of dollars' worth of car service without paying anything for it by sending cars forward the same day that it receives them. This also should be adjusted by changes in the division of the through rate. A road desiring to send 1,000 cars into the grain district to wait for the grain to grow, will have to make a special agreement not to ask rental for those cars while they are waiting. If freight is allowed, by agreement, to stand in the cars at destination, all the roads interested in the traffic will have to share in the burden. "Belt" and local roads which now pay no car service will have to be equitably dealt with, so that their revenue will not unduly suffer, and the same principle must be applied to cars, by whomsoever moved, which earn only a "switching charge."

An interchange rate must be pretty rigid in order to make the plan workable. Rigidity will mean constant little inequalities, which to the short-sighted manager will look like fatal faults in the system; but there is nothing to do but for each responsible officer to master the theory and to adopt and courageously support the plan—such plan as may be agreed on—and then compel the small injustices to wait for their settlement until the plan has had an opportunity to show its value in improving the service. The courage and foresight required to carry out a change in car service rates is of the same kind as that required to maintain freight rates when a weak road is believed to be secretly underbidding; but we may hope that the demands on one's grit and endurance will not be so severe as in rate-cutting contests. Any per diem plan under the sun must, if it corrects the evils of the mileage plan, decrease the income of some roads on some of their traffic; and the only direct way to recover such a loss is for the losing road to get more out of the traffic which is carried by the cars in question. And as every such road will demand a direct recompense for such losses, the question of increasing the percentage of earnings to delivering roads (and originating roads also) may as well be favorably taken up at the outset.

We need not take the time now to recount the great advantages of the straight per diem basis, as most of our readers already understand the situation. Those who do not can find them set forth in various articles in the files of the *Railroad Gazette* for 1895 and 1898. We have not had occasion to discuss the subject much for a long time, but in 1898 it came up in connection with the very hopeful but short lived experiment started in that year by Mr. Daly on the Illinois Central. We understand that the failure to get more companies to join was the only reason for abandoning that combined per diem and mileage plan. Under that plan, it will be remembered, balances were settled at a per diem rate, the rate being variable; varied according to the mileage run by the cars.

One advantage which should result from per diem interchange is the stiffening of demurrage rules. The demurrage associations have done great things,

but there is yet room for much greater improvement. When a road is paying out a fixed sum every day for borrowed cars we may hope that the way will be clear for a rule to charge the consignee on the same business-like basis.

But while, as we have said, the chief difficulties in the way of reform of car service are no less formidable now than they were when the reform was undertaken before there is a decided change of feeling; and this change appears to be based on two grounds: First, the enormous business of the past few years has shown more clearly the wastes of the present plan, and the need of the adoption of an equitable one; and, second, the amelioration of strife between roads, in consequence of the growing "community of interest," has shown to some, who did not appreciate the facts before, the foolishness of blindly adhering to tradition because of some short-sighted fear that a competitor will get an advantage for a month or two, or that the auditor will show an adverse car-service balance which it will require a little courage and philosophy to explain. The traffic department will still be able to scare the timid with the time-honored bugaboos, but there seems to be a widespread determination to deal with this feature of the subject more rationally than has been done in the past. The Eastern roads which are most likely to have to demand consideration, because they are so largely delivering lines, appear to be most enthusiastic for a change. Not all of them are yet reported as converted, but four or five of the very largest and strongest are already counted as ready to take decisive action. Roads in the West which formerly would not encourage even a demurrage association, are now collecting demurrage and are convinced of the value of the principle; and are ready to work for rational methods in interchange; so that the Association Committee is likely to find an encouraging field in which to conduct the investigations which it is to make between now and next April. Meanwhile there is room for any amount of missionary work, and every friend of per diem should set himself to make for it another friend. Above all every possible aid should be given to the committee, for strong and united action is a most important desideratum.

Heavy Passenger Locomotives of the Atchison, Topeka & Santa Fe.

In this issue is shown the general design of an Atchison, Topeka & Santa Fe passenger locomotive that will probably handle fast and heavy work on that railroad satisfactorily for a long time to come. This class of locomotives is of more than passing interest, not only because it indicates the growth of traffic on the system, but also because it represents in a measure the climax of preparations that have gone on steadily for some years in the motive power department, to meet increased requirements when San Francisco should become more of a Santa Fe city. Within the year Santa Fe terminal yard and dock work of great proportions has been put under way at San Francisco, and increased traffic with the far East becomes a nearer prospect. The effects of this have already been felt in the motive power department, and it was with these matters in mind that we gave in our issues of January 18 and January 25 an illustrated review of development of the Santa Fe's most powerful 10-wheel passenger locomotives, and an idea of what they were then doing.

Three classes of 10-wheel locomotives were considered in our review, and we mentioned the progressive withdrawal of these engines from the mountain divisions to the prairie country, and the substitution of heavier power in the mountains as the need arose, in pursuance of a well-defined policy. The motive power department of the Santa Fe was then considering the design of a passenger locomotive to meet the coming occasion and it was apparent that it must be a locomotive of greater power than any previously used on the system.

Inspection of the profile of the New Mexico division, shown in this issue, will put a greater value on comparison of the power of the three classes of locomotives which we have previously discussed, and the power of the new engines with which the Santa Fe now heads the list of powerful passenger locomotives of the world. The Class B-13 locomotive readily hauled four cars, including two sleepers, from La Junta, Col., to Raton, New Mexico, 104.5 miles, and took them over Raton Pass without a helper, the average speed from La Junta to Raton, including all stops being 22.3 miles an hour on the schedule of train No. 1, California Express. If five or more cars were to be taken over the Pass a helper engine was used

from Trinidad, Col., to Lynn, New Mex., the ruling grade being from 105.6 to 184.8 ft. per mile, Trinidad to Lynn. From Raton to Las Vegas, 110.8 miles, No. 1's average speed, including all stops, is 29.5 miles an hour, and the Class B-13 locomotive made the time with an eight-car train having the usual proportion of coaches, mail, and sleepers on California Express. On this part of the division the "Nine-Mile-Hill," that is, from Colmor to Levy, sets the gage of what a locomotive can pull, and eight cars was enough for Class B-13. Class B-14 set the rating a little higher on the average, making the time from Las Vegas to Glorieta summit with nine cars, the average speed of No. 1 from Las Vegas to Albuquerque, including all stops, being 24.4 miles an hour, and the greatest opposing grade 90.3 ft. per mile. When Class B-15 was built five cars could be taken over Raton Pass on No. 1's schedule without a helper, and ten cars were taken up the "Nine-Mile-Hill" on that schedule.

The estimated cylinder tractive effort of Class B-15 is 28,400 lbs. The cylinder tractive effort of the new Prairie type locomotive's working compound is 27,500 lbs., and when live steam is used in the low pressure cylinders the cylinder tractive effort becomes 33,000 lbs. From this it is apparent that in maximum effort the new locomotive is over 16 per cent. more powerful than the most powerful passenger locomotive previously used on the Santa Fe system.

The simple statement of these figures does not tell the tremendous advantage that will be gained in sustaining great tractive effort at high speed. The diameter of the driving wheels of the new engine is as 79 is to 67 when compared with the driving wheels of Class B-15, and with the unusual amount of heating surface that has been provided at the rate of about 70 sq. ft. of heating surface to one sq. ft. of grate area, a high average speed will be possible, particularly on the low-land divisions as from Coolidge to La Junta, where No. 1's average speed, including all stops, is now 24.6 miles an hour. The heaviest ruling grade on this part of the road is only one per cent., and that is in a section of 4.6 miles between Riverdale and Robinson. The work on this comparatively level division is often very heavy, and when the weather was bad double-heading was formerly necessary.

Probably the greatest satisfaction will be had from these new engines when they get to work on trains No. 3 and No. 4, the Santa Fe's California Limited, which has grown so popular in the past two years. In the territory that is gone through between Chicago and San Francisco, the capacity of these engines for both speed and power can be very well utilized in hauling the California Limited. There are 40 of these locomotives in the present order, and one of them will be fitted with a traction increaser designed by Mr. John Player and referred to in our issue of November 8. This device will increase the weight on drivers from 135,000 lbs., normal, to 160,000 lbs., the additional weight to be taken from the engine truck as well as from the trailing wheels. The addition of this device to an engine already so heavy on the driving wheels, will be awaited with interest. We have been permitted to inspect the drawings, but the drawings and description will not be published until the engine has been built and tested. The total weight of locomotive per square foot of heating surface, 50.8 lbs., found in a locomotive so heavy, shows very careful design.

The Northern Securities Company.

The outline of the formation of the Northern Securities Company and its relation to the Great Northern, the Northern Pacific and the Union Pacific, appears in our news columns. The upshot is the settlement of the serious and dangerous differences that had arisen beginning with the menace to the Union Pacific which was involved in the ownership of Chicago, Burlington & Quincy, by strong and hostile interests. Now the Union Pacific will have a holding in the proprietary company which owns the Great Northern and Northern Pacific, with three members in the board, and it will have one-half of the stock of the Chicago, Burlington & Quincy Railway Company which leases and works the Chicago, Burlington & Quincy Railroad—and again peace reigns.

In the territory of the United States the Pacific lines have shrunk to three systems—the Union Pacific (including the Southern Pacific), the combination of the Northern Pacific and Great Northern, and lastly the Atchison. The Canadian Pacific remains independent and there is no fear of an end to actual competition, but there is a greatly increased probability of peace, order, and stability, which will

be the best situation for all parties including the railroads, the producers, the shippers, and the consumers. To be sure, we do not yet foresee the end of the ambitions of the Missouri Pacific and Denver & Rio Grande interests. In the combination of those holdings there seems to be left the possibility of future troubles. Probably we need not worry to look so far ahead. Perhaps the Union Pacific interests will win the contest for the line from Utah to the southern California coast, and probably such a victory would considerably diminish the danger of the completion of a new and hostile Pacific line.

It was certain from the start that the formation of the Northern Securities Company would excite the fears and the active hostility of state officers and legislatures in the Northwest, and the purpose of the Governor of Minnesota to contest the legality of the sale of the Great Northern and Northern Pacific has already been declared, and is no doubt sincere. All of this was foreseen with perfect distinctness. The gentlemen who have brought about this new combination knew well what they were about. Probably Mr. Hill knows better than any other man, the temper, the traditions, and the motives of the people of the Northwest, individually and collectively; and Col. Clough, a Vice-President and General Counsel of the new company, has been for years minutely familiar with the legal and legislative struggles of the Great Northern. It would therefore be foolish and impertinent to assume that the purchase by the Northern Securities Company of the ownership of the Northern Pacific and the Great Northern is illegal; but apparently the elements of a fine contest have been collected.

The *Wall Street Journal* has recently made an estimate of the capitalization of the Northern Securities Company. The bonded debt of the Chicago, Burlington & Quincy Railroad, the Great Northern, and the Northern Pacific, including the C. B. & Q. "joint fours," amounts to \$617,000,000; the capital stock of the Northern Securities Company is \$400,000,000, making the grand total of \$1,017,000,000; it is thus the first billion dollar railroad corporation created. The mileage controlled is about 18,250 miles and the fixed charges are about \$32,000,000 a year. On the basis of last year's operations it is estimated that the new company might have paid its fixed charges and had left about 4 per cent. on its stock.

Some of the Uses of the High-Speed Brake.

A man always hates to pay out money for insurance; he always likes to pay out money to increase profits.—Casual Addresses.

In the discussion of a paper on "Brakes in Railroad Service," at the New York Railroad Club, Mr. R. A. Parke, of the Westinghouse Air Brake Company, made certain statements which so fully accord with views that we have entertained concerning the relations of the air brake to advancement in certain classes of passenger train service that we quote them as a text for some remarks on the use of the high-speed brake. Mr. Parke said:

"There is another feature of the paper which ought to receive careful consideration. In order to obtain the highest efficiency of the air brake, it is necessary that all the wheels of all vehicles should be supplied with brakes. This has become very generally recognized now, and, with the exception of those of the leading trucks of locomotives, all wheels of passenger trains are now usually efficiently braked. The importance of extending the practice to cover the wheels of the leading truck of the locomotive is urged in the paper. The paper deals with the subject from the point of view of its great importance in emergencies. It cannot be disputed that railroad trains are not properly provided with brakes, as a safety appliance, unless all the wheels are suitably braked. Of course, the highest characteristic service of the air brake is that which it fulfils as a safety appliance, and that function of any railroad appliance is pre-eminent in its demand for consideration. But there is another point of view that always appeals strongly to the railroad officer, which is practical economy in every-day operation. In these times of sharp competition in local (and especially in suburban) traffic, where trolley roads are putting steam roads to the test, it is of the highest importance that trains should not only be accelerated in the start as rapidly as possible, but also that the retardation during the stop should be as high as possible. Much has been done, at considerable expense, to secure the high acceleration. In former times—not so many years ago, either—almost any old rattle-trap of a locomotive was good enough for local trains and suburban service. Now we find that suburban service is calling into requisition heavy locomotives of great power for the comparatively small number of cars in such trains. But in maintaining high average-speed between stations there is no more advantage arising from the high acceleration, secured at such expense, than there is from high retardation during the stop. There are three essentials to high efficiency in

local passenger service; they are, first, to attain the maximum speed as quickly as possible; second, to maintain that speed as long as possible before applying the brakes for the stop, and, third, to stop as quickly as possible. The second and third of these essentials depends upon high retardation, so that it is of very great importance that all the wheels of the train should be braked as effectively as possible for that purpose. Further progress in the efficiency of this class of train service must be secured almost entirely through higher brake efficiency. Much advancement may yet be made in this direction, at a cost very small in comparison with that which has accompanied the attainment of high acceleration. High speeds are acquired between stations and the high-speed brake is admirably adapted for use in such service. Its adoption for local service would not only very materially increase the possible average speed and efficiency of that class of traffic, but thereby, also, the brake equipment of all passenger cars would become uniform and the cars could be interchangeably employed in local or high-speed express trains."

It is seven years since a series of experiments with the high-speed brake on the Pennsylvania Railroad demonstrated that trains might be safely, surely and cheaply stopped in less than 75 per cent. of the distance required with the ordinary quick-action air brake. Those experiments (which we were fortunate enough to see) were conducted with a train consisting of an eight-wheel locomotive and six eight-wheel day coaches, on a descending grade of twenty-nine feet per mile. At a speed of forty-five miles an hour, the train was stopped by the quick action brake in an average distance of 686 ft., which corresponds to a distance of 652 ft. on a level; and at sixty miles an hour, the average stop was 1,620 ft., corresponding to a distance of 1,514 ft. on a level.

These stops were made with the aid of brakes on the leading truck of the locomotive, a condition which unfortunately exists upon only a small proportion of the passenger trains in this country. If there had been no locomotive-truck brake in these tests, the corresponding stops on a level would have been about 694 ft. at a speed of forty-five miles and 1,612 ft. at sixty miles, which represent the best stops that can be made by the great majority of passenger trains when the brakes are in first-class condition.

The same train was stopped, under the same conditions, by the high-speed brake in an average distance of 1,168 ft. at a speed of sixty miles an hour, which is equivalent to a distance of 1,111 ft. on a level, and in correspondingly shorter distances than by the quick-action brake, at lower speeds. In other words, at sixty miles an hour, the gain with the high-speed brake was more than 26 per cent. of the distance run with the quick-action brake, or 403 ft.

While the increased efficiency of the high-speed brake is proportionally even greater at the lower speeds, its advantage is more conspicuous at the high speeds because of the large actual reduction, in feet, of the distance that must be traversed when the speed materially exceeds 45 miles an hour. At speeds below 40 miles an hour, the distance varies quite nearly as the square of the speed; but when the higher speeds are approached, the distance increases at a ratio considerably greater than that of the square of the speeds (the coefficient of friction falls as speed rises), so that at 60 miles an hour the stopping distance of the high-speed brake is 500 ft. less than that generally required and 400 ft. less than the best stop that can be made with the quick-action brake, including the locomotive-truck brake. At the still higher speeds now daily occurring in regular service, these differences in favor of the high-speed brake increase rapidly.

It may be that it is for this reason that the Westinghouse Air Brake Company, in its literature upon the subject of the high-speed brake has seemed to imply that the field of usefulness of this brake is limited to those trains which continuously maintain high speeds for long distances. But we have long wondered why this limit should be set at continuous high speeds. Trains in all classes of passenger traffic, including suburban service, and even in some classes of freight service, regularly reach very high speeds in every day service and the public is entitled to just as much protection in one case as in the other. In fact, it is probable that the trains of continuous high speed need the protection of efficient brakes rather less than those which, because of frequent stops, can keep their lower average speeds only by frequent bursts of high speed. Trains scheduled at high average speeds are usually more favored with a clear right of way, and are therefore less liable to meet the emergency in which security of life and property depends upon the ability to stop quickly.

The high-speed brake has been in continuous, successful and satisfactory service now for upward of seven years, upon various fast trains under different conditions in different parts of the country; it has

proved itself reliable and efficient, and, notwithstanding the high retardation secured, its record is generally said to be characterized by special freedom from injury to wheels, probably because of the definitely established maximum cylinder pressure in service applications, which is not affected by fluctuations in train-pipe pressure. Yet, to-day, considerably the greater part of all passenger trains must, in an emergency, run a distance 45 per cent. greater than that which would be required to stop if they were equipped with the high-speed brake, and nearly all of the remaining trains must run 36 per cent. further.

But this is not all. As Mr. Parke has stated, the practical economy and efficiency of railroad operation appeals to the railroad manager in cases where added security may not alone seem to justify expenditure. This is merely the working of the ancient business principle expressed in the words at the head of this article. Pushed by competition, particularly where trolley lines have sprung up in the outskirts of large cities, the means of holding local and suburban traffic have become serious questions with many railroad lines. The small, light locomotives of former times have disappeared from such service and heavy locomotives, of exceptionally high power for such light trains, have taken their place. This has been for the purpose of starting trains quickly and of bringing them up to speed in a short distance. But high average speed requires that the maximum speed shall be kept till close to the stop, and that the stop shall be made in the shortest possible distance, just as much as it does that the maximum speed shall be quickly reached. While railroads have been at large expense to get quick acceleration they have done much less to get quick retardation. Only a few have even gone to the extent of putting brakes on the leading truck of the locomotive and none have done more. Much more may yet be done to improve suburban service through greater efficiency in stopping, by the moderate expenditure of something like twenty-five dollars a car. This, we are assured, will cover the extra cost of the high-speed attachments. This step would carry still further the gain that has been secured by increasing the starting efficiency, at the cost of powerful locomotives.

It is very noticeable that the disagreeable and damaging shocks which are apt to accompany emergency applications of the brakes on long trains (or on even short trains) at low speeds, are absent on passenger trains of ordinary length at high speeds. The high brake-cylinder pressures of the high-speed brake are dissipated and reduced to so moderate a limit before the low speeds have been reached, near the end of the stop, that the danger of wheel sliding is no greater than with the ordinary brake, and there thus appears to be no reason why the maximum efficiency of the high-speed brake should not be utilized in express suburban service, where the conditions are such that a speed of 45 miles or more may be attained between stations. With the heavy locomotives now employed in local service, much higher speeds may be so attained, if accompanied by short, quick stops, and such an ideal service is therefore not merely possible but is cheaply within the reach of all.

The high-speed brake guarantees a superior protection to life and property that entitles it to a place on every passenger train; and it does several other things which help to establish and maintain an ideal express suburban service.

Annual Reports.

Baltimore & Ohio.—In the annual report of this historic company (the 75th issued by the corporation, a record of continuous history which no other railroad in this country can equal) is a brief list of the changes of officers in the past year, which is the only definite record made of the most important change affecting the company's history taking place in the year. The election of Mr. Loree as President turned the active responsible management of the property to the control of the Pennsylvania Railroad. That company now has five of its own vice-presidents on the board of directors of the Baltimore & Ohio, and dominates the present policy of the company.

The Pennsylvania's large interest in the company (understood to be over \$40,000,000 in the stock) and the stability in rates, under the present relations of the two companies make it likely that the record of revenue results to be found in the current report will not be disturbed in future depression of business by intense rivalries for tonnage. Largely because of more stable rates, in 1901, the Baltimore & Ohio's revenue increased more than in any previous year, although this is not true of the growth of tonnage. Increase in gross earnings was \$4,331,300, or over 10 per cent., of which \$3,566,000, or over 11 per cent. was in freight receipts. Passenger movement shows a decrease, although revenues of that department gained by \$619,700, or 7½ per cent. through

higher average rates, resulting from larger local traffic. These changes in revenue brought gross receipts up to \$47,114,000 for all the lines, and net earnings to \$16,016,000. The company which, in 1896, went into bankruptcy earned last year \$7,637,600 over fixed charges, and almost \$5,000,000 over the preferred stock dividends, which are limited to 4 per cent. The changes in the income account for the past two years are as follows:

Earnings.	1901.	1900.	Changes.
Freight	\$35,553,872	\$31,987,854	Inc. \$3,566,018
Passenger	9,054,602	8,434,902	Inc. 619,700
Mail	1,191,073	1,184,650	Inc. 6,423
Express	942,018	849,535	Inc. 92,483
Miscellaneous	372,866	326,167	Inc. 46,699
Total earn.	\$47,114,431	\$42,783,108	Inc. \$4,331,323
Operating exp.	31,046,231	27,828,217	Inc. 3,218,014
P. c. exp. to gross. .	65.89	65.04	Dec. .85
Net earnings	\$16,068,200	\$14,954,891	Inc. \$1,113,309
Total net inc.	16,924,993	15,468,414	Inc. 1,456,579
Charges	9,287,381	8,536,786	Inc. 750,595
Dividends	3,300,000	3,073,560	Inc. 226,440
Surplus	\$4,337,612	\$2,833,600	Inc. 1,504,012
Improvements	2,740,932	2,540,531	Inc. 200,401
Balance	\$1,596,680	\$293,361	Inc. 1,303,319

†Dividend rate actually increased, though not shown in system of accounts.

Increase in operating expenses as above reported is chiefly attributable to increasing maintenance charges. Transportation cost, despite the increased tonnage and the inconvenience of train handling through the great amount of improvement work going on continuously, and lack of adequate equipment, shows a steady decrease in the proportion of receipts absorbed in that account. Of the increase in expenses, in the past year, much the largest share was accounted for by growing charges to maintenance. The increase in maintenance of way expenses in the year was \$912,954, or 19 per cent.; in maintenance of equipment, \$979,300, or over 19 per cent., a total of \$1,892,000 under both heads, as compared with an increase of \$1,047,000, or 6½ per cent. in cost of conducting transportation. The division of operating expenses in the last two years, and the ratio of each account to gross receipts are given below.

	1901.	1900.	Per cent. to gross receipts.
			1901. 1900.
Main. way	\$5,721,695	\$4,808,741	18.4 17.3
Main. equip.	6,104,310	5,125,050	19.7 18.4
Cond. trans.	16,609,911	15,562,971	53.5 55.9
Gen. exp.	2,610,315	2,331,455	8.4 8.4

Increasing equipment and maintenance of way expenses only in part reflect the extraordinary work which is being carried on by the company in the improvement of its property for economical service and in the addition and extension of facilities for handling a tonnage which in each year since the receivership, has grown faster than the resources of the company have permitted it to adequately provide for. In the past fiscal year, for instance, improvement expenditures were in excess of \$9,000,000 and the plans under way could easily have absorbed further sums if it had been possible to carry on the work on any greater scale than was done. Aggregate expenditures for construction and betterment in the year were \$9,221,995, as against \$3,035,000 in 1900, and \$1,122,800 in 1899, excluding in the latter year the expenditures on the Baltimore & Southwestern, not then reorganized and consolidated with the older company. As may be judged from the extent of the expenditures, the work carried on included every class of improvement and betterment and was in extent far too great to permit any summary here. The list of the different works as itemized in the report takes up four and a half pages, with two columns to the page. In the past year, while the heaviest expenditures continued as in previous years, between Baltimore and the Allegheny Mountains, the improvements on the Pittsburgh division and west of the Ohio River absorbed a much larger share of the energy of the officers, and of the funds, than in any previous years. The record of all this improvement work, while it is not expanded in the President's summary, is set down in admirable form in the statistical part of the report, and a table appearing in the President's remarks this year, as in previous years, enables the reader to trace the progress of the improvement from the Easterly divisions to those further west. This allotment of the improvement expenses by operating divisions for three years past is shown below.

	1901.	1900.	1899.
Lines east of Balto.	\$328,422	\$221,160	\$216,795
Main line and branches. .	3,368,697	944,447	267,040
West Va. & Pitts.	202,635	102,901
Monongahela	36,492	7,839
Pittsburgh	1,441,094	720,734	345,100
Middle	211,518	449,638	293,873
North Western	1,865,740	588,034
Southwestern	1,767,347
Total	\$9,221,995	\$3,034,754	\$1,122,806

Of the \$9,000,000 construction expenditures in 1901, the sum of \$2,500,000 was secured by an appropriation out of current income, while \$6,266,000 was capitalized in construction accounts, and \$566,000 more was charged to the construction accounts of subsidiary roads in the system. These expenditures, however, did not include all the funds provided for the improvement and increase of the company's facilities. For equipment nearly \$3,000,000 was spent covering the cost of 111 locomotives, 1,325 express cars, and certain other equipment against which, however, there was credited \$124,200 as value of 25 locomotives, 751 freight cars and other equipment put out of service.

Further than this, the company purchased through car trusts equipment valued at \$3,215,000, which includes 10 locomotives, 25 day coaches, 3,000 freight cars, and 1,250 steel cars, the latter costing \$1,138,727. Exclusive of this car trust equipment, all additional rolling stock

and motive power, the company's equipment inventory shows an increase of 86 in locomotives owned.

The reason for these heavy equipment additions is clearly enough apparent in the figures of tonnage movement. Last year tons carried were over 33½ millions, whereas, in 1898 they were less than 22 millions, and in 1895 just above 16,000,000, although that figure was 2,623,000 tons more than reported in 1894. Far the largest share of this increase has been in the development of soft coal movement, particularly from the West Virginia coal fields, whose present extensive development was materially aided by the energy and policy of the receivers. Of the increase of 1,623,000 tons, or 5 per cent., in the freight traffic of the Baltimore & Ohio last year, 1,188,400 tons, or nearly 10 per cent., was in soft coal, which is now 39.8 per cent. of the company's tonnage. The next largest single class of freight consists of iron castings and machinery, 6¼ per cent. of the total, and in which item the company reports a gain of 418,000 tons, or 25 per cent. for the year.

Soft coal ton-mile rates were 3.49 mills last year against 2.77 mills in the previous year, and the low figure of 2.64 mills in 1899 for soft coal. The average ton-mile revenue on all freight was 4.98 mills last year, against 4.71 mills in 1900 and 3.90 mills in 1899 on the eastern lines. Passenger traffic did not share in 1901 in the growth shown in the freight business. Number of passengers carried decreased by 5,000 to 11,161,000, and passengers carried one mile also decreased slightly. As against this, there was an increase in passenger-mile rates from 1.839 cents to 1.975 cents, and although there was an increase in passenger train mileage this gain in average rates brought the passenger-mile revenue from 93.8 cents to over 99 cents.

Manhattan.—The Manhattan Railway Company has issued its statement of operations for the years ending Sept. 30, 1901 and 1900:

	1901.	1900.
Gross (all sources)	\$10,455,872	\$9,950,735
Expenses	5,328,649	5,195,312
Net	\$5,127,223	\$4,755,423
Interest and taxes	2,683,132	2,688,644
Net income	\$2,444,091	\$2,066,778
Dividends, 4 per cent.	1,920,000	1,920,000
Surplus	\$524,091	\$146,778
Previous surplus	4,309,626	4,162,848
Refunding of tax.	132,639
Surplus profit and loss.	\$4,966,356	\$4,309,626
Operating per cent. (excl. tax.) .	50.97	52.21
Operating per cent. (incl. tax.) .	59.32	60.98
Passengers carried	194,152,316	183,788,851

The President said that improvement and enlargement of the company's facilities have been steadily pushed. The line to Tremont has been put in operation, and the new terminals in the Bronx have increased facilities, meeting an immediate response in increased traffic. The change to electrical equipment has made progress. The central power station is completed and also three substations, and machinery is being installed in all of them. Motor equipments are arriving, and deliveries of 300 new cars has begun. The engineers expect to turn the first 8,000 h.p. engine and dynamo by Dec. 1, and run the first trains on Second avenue during the month, to be followed up as rapidly as the equipment can be assembled and put in operation.

The railroad commissioners of Texas, acting under the law recently passed in that State, have notified all railroad companies to make reports to the commissioners on or before Feb. 1, 1902, describing the conditions at the various crossings, in the State, of one railroad with another, as regards the probable cost of separating the grades; or if separation is impracticable, the probable number of trains which will pass over the crossing, the purpose of the commission being to inform itself as to the propriety of ordering "gates" at each crossing. The law apparently requires the commission to prescribe the establishment of safety devices of some kind at every grade crossing; and interlocking signals are, presumably, contemplated; although the language of the statute appears to be rather vague. The order now issued was formulated on the recommendation of a committee consisting of Messrs. L. J. Polk (G., C. & S. F.), E. B. Perkins (St. Louis Southwestern), and J. W. Maxwell (M., K. & T.).

The Ball Brothers' Glass Manufacturing Company, of Muncie, Ind., evidently ships a good deal of freight, or else attaches a good deal of importance to what it does ship, or, perhaps, "thinks a good deal" of the railroad agents from whom it gets rates, for it gave a banquet the other night to 62 of these gentlemen. From a list printed in a local paper it appears that nearly every one of these 62 was a traveling or general freight agent, and about every road within a thousand miles seems to have been represented. We note the incident as a side light on the "industry" of freight soliciting and the costliness of it. If one were to take the number of cities in the country which are as large as Muncie or larger, and multiply it by 62, and again by the estimated average number of heavy shippers in each city, he would have a rough and inaccurate, but still suggestive, indication of the number of visits that must be made by freight solicitors in the United States once in, say, every month or two. And yet the proposition to entirely abolish competitive soliciting has been theoretically approved, as a wise business measure, by nearly every thoughtful student of the railroad problem. That is to say, everybody agrees that the great majority of freight solicitors might be set to doing

something else without any detriment to the industrial or commercial interests of the country, and without any permanent harm to railroad interests. But to say that this expense might or could be saved is, of course, quite a different thing from telling how to do it.

The Knecht Friction Drill.

The accompanying engraving shows a friction sensitive drill made by the Knecht Brothers Co., Cincinnati, Ohio, which is being used in railroad shops with good results. The driving and variable speed mechanism consists of two cones and a friction roller. The power is transmitted from the lower cone to the friction roller and from this to the upper or spindle cone. The speed of the drill spindle is varied, without stopping the machine or shifting belts, by sliding the frame carrying the friction roller up or down the cones. The frame is shifted by turning the hand-adjusting nut under the lower driving cone. On the slide are graduations showing the position for the proper speeds to drill cast-iron. Extending through both bearings of the housing is a sleeve or bushing to which the driving cone is fastened, relieving the spindle of lateral pressure. The spindle is balanced by a coil spring. Graduations on the sleeve passing through the spindle head

indicate the depth to be drilled. In addition there is a stop collar on the sleeve which can be adjusted and set, so as to drill any number of holes to the same depth without referring to the graduations on the sleeve.

The driving pulleys are mounted in a frame which is adjustable on the column, and provision is made for securing any belt tension desired. An endless belt is furnished with each machine. A square table swings on the column, allowing it to be swung out of the way when drilling work held in the lower knee. The attachments furnished with the machine include: A cup center for use in drilling holes in the ends of shafts; a center point for supporting work when one center has been drilled; a V-block with stem for supporting shafts to be drilled at right angles to the axis, and a supplementary V-block for drilling holes out of center when preparing to turn shafts eccentrically.

Emigration to the Northwest.*

More than 10,000 people have been placed on farms in the northern portion of Idaho and the State of Washington this year. Immigration to Washington is in a prosperous condition. We have placed 500 families on the Sunnyside irrigation ditch in Yakima, and in one county in eastern Washington placed 680 people within a short time, and these are only illustrations. On the Moxie ditch, in Yakima county, and adjacent to the town of North Yakima, we landed one party of Hollanders from Iowa that it required nine cars to transport. Those people bought 5,000 acres of land, paying \$60 an acre for it, and in many cases paid the cash. Those who did not pay cash made enough this season from potatoes alone to largely pay the original price. Two years ago, on the Seattle division, we saw that any man who wished to engage in dairying could have a splendid chance where the timber had been cut. Cattle can graze around stumps that it would cost \$300 an acre to remove. I went back to St. Paul, got out printed matter calling attention to market conditions and prices for dairy products in this portion of the State, and on every milk can that came into Chicago, from Michigan and Illinois, plastered one of those labels. As a result of this form of advertising we have placed in such localities over 150 families, and are constantly adding to the number.

Through portions of Wisconsin and Michigan, where the lumber industry is almost at an end, we spread literature pertaining to the possibilities in the lumber industry of the Northwest, combined with that class of farming which those people understood; and as a result we have located over 200 people in Snohomish county alone. In almost every portion of this State are inducements that would reach certain people in certain localities. We do not try to induce a fruit farmer to come to the lumber woods, but wait until we see the exact place which would be suited to his experience, and wherein he could make a success. We find that to satisfy one responsible man is to make many friends through him.

The Northern Pacific distributed through my department last year 6,000,000 pieces of literature and paid in postage \$4,200. Every piece went on personal application, or to those who had been addressed by some one of our emigration agents. In all cases this literature is impartial.

The way to build up the State of Washington is for

*From an interview at Seattle with C. W. Mott, General Immigration Agent of the Northern Pacific.

the Chambers of Commerce and other municipal bodies to give absolutely impartial statements of fact, uncolored and without reference to other localities or cities. If we are given an opportunity to distribute matter of this kind we are always glad to do so.

I do not believe that cheap fares for "homeseekers" are ultimately the best. The man who takes advantage of an exceedingly low rate is not always the man that makes the best pioneer or citizen. It is too frequently the avenue of change for the restless, the discontented and impecunious. Since the cheap rates expired in May we have placed more and better people here as a whole than we did during the time they were in force.

TECHNICAL.

Manufacturing and Business.

The Consolidated Car Heating Co. has moved its Eastern office from 901 Havemeyer Bldg., New York, to 634 Park Row Bldg., the same city.

W. H. Patterson, Chairman of the Board of McCord & Co., and Vice-President of the Illinois Car & Equipment Co., died, Nov. 18, of typhoid fever. Mr. Patterson was 46 years old and was well known among railroad men.

The contract for the electric headlights and signal lamps for the Manhattan Elevated equipment has been placed with the Dressel Railway Lamp Works, of New York city. We understand the order amounts to over 5,000 lamps.

Thornton N. Motley Company has recently received a large order from Costa Rica for machine shop tools of different classes; also orders from London for electrical material of various kinds. It has also received orders from many of the tramways of Great Britain for Corning brake-shoes.

Pending the completion of many tests of their specialties in various parts of the country, the business of T. H. Symington & Co., of Baltimore, Md., will be conducted as heretofore from their Baltimore office under the direct supervision of Harvey Middleton, Managing Director. W. R. Bean has been appointed general inspector of the company, and will look after these tests.

The twenty-first annual convention of the Sherwin-Williams Co. was held at Cleveland, Nov. 4 to 9. It was in many ways the most successful meeting the company has ever held. The Sherwin-Williams Co. has just rounded out the largest year in its history—the largest in total business and also in the percentage of gains in all departments. Fifteen new salesmen have lately been added to the traveling force, and new buildings and equipment have been added to the manufacturing facilities. In addition to the entirely new plant at Newark, N. J., the company has doubled the size of its Chicago factory, added a new building to the Montreal plant and three buildings at the Cleveland plant. There were in attendance at this year's convention 125 men, consisting of the traveling representatives and managers and officials of the company. The traveling force numbers at present 100.

Iron and Steel.

It is announced that the United States Steel Corporation has opened a Bureau of Mines and Mining in Pittsburgh, with R. S. McDonald in charge.

The Tennessee Coal, Iron & Railroad Co. has advanced the price of pig iron 50 cents a ton.

The Alan Wood, Iron & Steel Co., of Philadelphia, was incorporated in Pennsylvania, Nov. 15, with a capital stock of \$1,250,000.

The Steel Wheel & Wagon Co., capitalized at \$350,000, is building a plant in Pueblo, Colo., to make steel wagons. Wm. H. Schofield is President and Manager.

Nathaniel Baxter, Jr., has resigned as President of the Tennessee Coal, Iron & Railroad Co. and will, on Dec. 1, become President of the Cumberland Coal & Coke Co.

The Pennsylvania Steel Casting & Machine Co., Chester, Pa., has elected M. H. Bickley, President; George M. Booth, Secretary and Treasurer, and Frederick Baldt, General Manager.

The Lackawanna Iron & Steel Co. has bought controlling interest in the Cornwall Iron Co., owning blast furnaces at Cornwall, Pa. It is said that an open-hearth mill will be built.

The rail mill of the Tennessee Coal, Iron & Railroad Co., which has been building for some months at Ensley, Ala., is practically finished and will probably be put in operation about Jan. 1.

The United Engineering & Foundry Co. has absorbed the plants of the Frank-Kneeland Machine Co., McGill & Co., and Lincoln Foundry Co., all of Pittsburgh, Pa., and the Lloyd Booth Co., of Youngstown, Ohio.

The United States Steel Corporation has contracted with the Valley Furnacemen's Association to buy the entire Bessemer iron output of the furnaces during December, amounting to 50,000 tons, at \$15.25 at the furnace.

The York Bridge Co. has been incorporated under the laws of Pennsylvania to engage in bridge building. The incorporators are: Guy Webster, N. P. Webster, C. J. Dreary and George W. Dreary, of York, and J. P. Leher, of Pittsburgh.

In spite of the official denials that the United States Steel Corporation is to absorb the Pressed Steel Car Co.,

the report still continues in circulation. The report seems to be founded largely on the fact that Charles T. Schoen, formerly President of the Pressed Steel Car Co., recently sold his large interest in that company.

The Bureau of Ordnance, Navy Department, has let a contract to the Fore River Ship & Engine Co., of Quincy, Mass., for 60 sets of nickel-steel forgings for the 3-in. rapid-fire field guns, and 15 sets of steel forgings for 4-in., 40-caliber rapid-fire guns. The company is to begin delivery in 50 days and complete it in 150 days. The Fore River plant has now been equipped for work of this kind, having one of the largest steam hammers in the country. The forgings for the 4-in. guns include a jacket, a tube, two hoops and a plug, the guns being 13 ft. 4 in. long. The forgings are to be delivered rough-bored and turned and will be finished and tested by the Government.

The Manhattan Terminal of the Brooklyn Bridge.

A Director of Brooklyn Rapid Transit says: "Our company is powerless to enlarge its facilities to do business more comfortably to the public traveling to and from Manhattan until the approaches at the Manhattan end of the Bridge are enlarged. It rests with the Manhattan Borough officials to keep the people in transit facilities. We are willing to spend money to add to our earning capacity by enlarging facilities. Our great difficulty is in getting people across the bridge. Heed should be given as soon as possible to the report of the Board of Expert Engineers on the Manhattan terminal of the Bridge. These engineers suggest a plan of relief. Our hope is that the new administration of Greater New York will give attention to this burden on the people, and help us to give the relief we should like to give if the city would allow us to do so. The engineers say in their report, and we know it to be true, that no other bridge or railroad terminal in the world handles half as many people daily, or yearly, as does the Brooklyn Bridge."

Ties from South America.

The Pennsylvania has ordered from South America a lot of hardwood sleepers which will be tried in the tracks in and around Philadelphia. The sleepers are of Morawood, said to be from British Guiana. They cost about \$1.50 each at Philadelphia and are expected to last a great many years. About seven years ago the company put down a few of these ties at Frankford Station, on the New York Division, and they are said to be now as good as the day they were put down.

Standard Ship Building Company.

The Standard Ship Building Co., formerly owned by Hugh Ramsay, Perth Amboy, N. J., has elected the following officers: President and Manager, C. O. Liljgren; Vice-President, W. E. Ramsay; Secretary and Treasurer, A. H. Crowell. M. A. Edgar, A. Lyon, C. F. Hall, A. L. Ramsay and C. Lee Straub, in addition to the officers, are the directors.

Consolidated Lake Superior Company.

At the adjourned annual meeting of the Consolidated Lake Superior Company, held in New Haven, Conn., Nov. 18, the following directors were elected: Edward J. Berwind, William L. Bull and Charles E. Orvis, New York; H. A. Berwind, James Butterworth, W. P. Douglas, F. V. Douglas, John S. Freeman, Edward C. Lee, F. S. Lewis, John Pitcairn, S. M. Provost, Samuel Rea, T. C. Search and James S. Swartz, all of Philadelphia; F. H. Clergue, Sault Ste. Marie, Ont., and Lynde Harrison, New Haven.

The Simplon Tunnel.

Sept. 20 the excavation from the south of the Simplon Tunnel, which had been wholly through hard gneiss, at a distance of 14,159 ft. from the entrance, reached crystalline limestone. The drilling progressed favorably in this till Sept. 30, when water-bearing strata were penetrated, from which streams projected with such force that the drills could only with difficulty be removed, and work in that adit had to be suspended. In the parallel adit it was continued, but only with hand drills. The aggregate penetration at the end of September, from both ends, was 33,125 ft. Ventilating apparatus has been established, worked by two turbines of 250 h.p. each. The Italian Minister of Public Works, after having visited the tunnel, says that the situation is pretty bad. The water stands waist high to the workmen and the contractors seem to be unable to devise any scheme for getting it away fast enough, but the latest despatches from Rome are that the work is still going on. The vein of water penetrated by the drills on the southern part of the Simplon Tunnel seems to be a serious matter. It passes about 80 gals. per second at a pressure of about 3,000 lbs. per sq. in.—which suggests that a lot of power is going to waste. It has been suggested that the water comes from a well known mountain lake. It is reported that the management contemplates as a last resort making a curve in the tunnel to avoid the water-bearing strata.

Gulf Coast Shipbuilding Plant.

Some months ago we mentioned that the Gulf Coast Shipbuilding & Dry Dock Co. was formed. The company has recently been incorporated under the laws of Alabama by a special charter, permitting it to build a shipyard and marine railroad on the Bay of Mobile and a dry dock and repairing plant at the Port of New Orleans. These directors have been chosen thus far: Charles W. Jesup, S. B. McConico and Cassius M. Wicker, of New York; Alfred S. Elliott, of Wilmington, Del.; Robert C. Morris and Lewis Johnson, of New Orleans, and Patrick

J. Lyons and E. L. Russell, of Mobile. The officers are: President, Charles M. Jesup; Vice-President, Cassius M. Wicker; Second Vice-President and Secretary, S. B. McConico; Third Vice-President and Treasurer, Robert C. Morris. The capital is \$5,000,000, and an issue of \$4,000,000 of first mortgage 35-year 5 per cent. sinking fund bonds will be made to cover the cost of the acquisition, construction and initial equipment of the two plants. Alabama Point, the proposed location of the plant, is situated on the Bay of Mobile, about 23 miles from the City of Mobile and six miles from the open Gulf, and is connected with Mobile by a branch of the Mobile & Ohio Railroad, besides being near the coal and iron fields and the timber lands of Alabama.

The German High-Speed Experiments.

O. Lasche, Chief Engineer of the General Electric Co., of Berlin, which company, together with Siemens & Halske, is making the experiments on the Prussian Military Railroad to ascertain the highest practicable speed, read a paper before the Railroad Science Society at Berlin early in October, in which he gave some account of what it is hoped to accomplish. Between towns at some distance apart, where there is considerable travel, time is to be saved not only by greater speed but by shorter intervals between trains. Therefore, in most such cases, the policy to be followed is to run single motor cars, with much less capacity than the present express trains, but at short intervals. These comparatively light trains, without reciprocating parts, can run safely over a permanent way where an ordinary express train could not keep the track at the speeds contemplated. For city and suburban traffic, on the other hand, the use of single cars is not likely to be adequate, but by trains of several cars, including a motor car at each end, many more passengers may be carried than by ordinary passenger trains moved by steam locomotives.

Pittsburgh Valve, Foundry & Construction Co.

The Pittsburgh Valve, Foundry & Construction Company will soon centralize in its new plant in Railroad street, between Twenty-fifth and Twenty-sixth streets, Pittsburgh. The new plant is being finished by the Riter-Conely Manufacturing Co. These works, with the pipe-fitting department at Twenty-eighth and Smallman streets, will employ 600 men. When the Lawrenceville plant is finished the company will abandon all its down-town works. These include the works of Atwood & McCaffrey, the Shook-Anderson Manufacturing Company, the pipe-fitting department of the Wilson-Snyder Manufacturing Company and the foundry of Alexander Speer & Sons. The latter has already been moved. The new foundry has a maximum capacity of 50 tons of castings daily.

New Navy Yards.

The President has signed an order creating a naval reservation at Olongapo, Subig Bay, Luzon, P. I. The Naval Board, of which Rear Admiral H. C. Taylor, U. S. N., is President, has prepared plans for the new naval station which the Department will proceed to build. The estimated cost of equipping the station for efficient work of repair and outfitting of vessels, pending the general development, is \$12,903,500, and the ultimate cost will probably be twice that amount. The same Board has prepared detailed plans for the naval station at Charleston, S. C. The dredging of Cooper River to 32 ft. is recommended, the dredged material to be used to raise the grade. Instead of piers, a basin is recommended, dredged to 32 ft. below mean low tide, to contain two piers where vessels may lie and not obstruct the channel. A site for two dry docks was selected and the water front will be protected by a sea wall 32 ft. deep in front.

A New Acetylene Generator.

The United States Consul at Gothenburg, writes: "Mr. Erik Cornelius, chemist at the carbide factory at Trollhättan, Sweden, has invented a new acetylene gas generator, called the 'Trollhättan.' The falling of the carbide into the water is automatically regulated by a rubber ball, which, as soon as it is filled with gas, closes the valve between the carbide and the water. When the volume of gas decreases, the hollow rubber ball contracts and the feed valve again permits the carbide to drop. The gas is stored partly in the rubber ball and partly in the space between the funnel-shaped carbide magazine and the water. If much gas is generated, the water is pressed through valves into the water jacket in the sides of the apparatus, thus furnishing more room for the gas. A separate gas tank is therefore not needed. Should too much gas be produced, water and gas escape through a safety valve. Common carbide is used; no cartridges. The gas is scoured by being allowed to pass through the carbide magazine, where the carbide absorbs the moisture. As there is no gas tank, and the quantity of gas stored thus is insignificant, it is considered that the fire insurance companies will, without raising the insurance premiums, approve of the apparatus, even when it is placed in dwelling houses.

New Naval Estimates.

The Secretary of the Navy, in his annual report, recommends that the following new ships be appropriated for by Congress for the fiscal year 1902-1903: Three first-class battleships; two first-class armored cruisers; three gunboats of 1,000 tons displacement, and three of 200 tons displacement for insular service; three steel sailing ships of about 2,000 tons displacement; one collier of 15,000 tons; four tugboats and three picket boats. The Secretary asks that the number of officers be increased, and he endorses the recommendation of the Chief Hydrographer

that a suitable building be provided at Washington for the Hydrographic Office, to cost, it is estimated, \$230,000. The naval estimates include: Machinery at the naval gun factory for existing and proposed shops, \$100,000, and a steel castings plant, \$10,000. For new buildings and shops and extensions at the Washington Navy Yard, \$622,000. A floating dry dock at the Portsmouth (N. H.) Navy Yard, \$500,000; new buildings and improvements at the Boston Navy Yard, and a plant for housing torpedo boats, in all, \$1,127,700; new works, buildings, and improvements, New York Navy Yard, \$3,110,000. New buildings and improvements, including additional land, at the Norfolk (Va.) Navy Yard, \$1,208,500; naval station at San Juan, Porto Rico, \$2,613,000, including land, a masonry dry dock and extensions of coaling facilities; for housing torpedo boats at Pensacola, \$650,000; for the naval station at Tutuila, Samoa, \$108,000; for the naval station at Cavite, P. I., \$381,000, including a refrigerating plant; and for the beginning of a complete naval station at Olongapo, P. I., \$1,443,000; for naval magazines and defenses of island stations and coal depots, \$1,500,000.

Dredging at Manila.

Major Sears, Corps of Engineers, U. S. A., the engineer officer in charge of river and harbor work at Manila, P. I., is dredging the Pasig River with his own force instead of by contract. The only bid he received for the work was 33½ cents a cu. yd., while the work under Major Sears costs about 5¼ cents. During August last about 27,000 cu. yds. of material was dredged between the harbor and the river. The channel from the Bridge of Spain to the mouth of the Pasig River will be 18 ft. deep and 250 ft. wide. A dredge has been ordered from the United States for work above the Bridge of Spain, where the channel will be dredged to 6 ft. The canal between the river and the harbor will be dredged to 15 ft. at low water.

New Car Works for Middletown, Pa.

A charter was issued in Pennsylvania, Nov. 14, to the Middletown Car Works, with a capital stock of \$100,000. The incorporators are Arthur King, of Middletown; Geo. I. King and Paul A. Kunkel, of Harrisburg.

Ship Yard for St. Clair, Mich.

The Columbia Iron Works, in which J. E. Botsford, T. D. Jenks and Charles O. Duncan, of Port Huron, Mich., are interested, will build a ship yard at St. Clair, Mich., about 12 miles below Port Huron on the St. Clair River, to build steel ships.

The Committee On Rail Sections.

The matter of the appointment of an engineering committee of the American Society of Civil Engineers to consider a revision of the standard rail sections is yet undecided. Up to the latest date reported to us the ballots received numbered 677. It may be decided that 25 or 30 more ballots will be necessary before they can be canvassed. So if there are still dilatory members who feel any interest in the subject they had better vote.

Car Lighting.

The geographical extension on this continent of the Pintsch lighting system in the past two or three years, has been important. The growth to the north in the Dominion of Canada has been especially rapid and now Pintsch light is being introduced into Mexico, and it is believed that the number of cars lighted by that system in Canada and Mexico will multiply fast now that the first steps have been taken in both countries. During October and part of November the Mexican Central Railroad has ordered from the Safety Car Heating & Lighting Company Pintsch equipments for 52 cars and it is probable that all their better class of cars will be equipped with that system as fast as they are put into the shops for general repairs. Work is now in progress on the Pintsch gas plant in the City of Mexico. This plant is being built for the Mexican Central Railroad, but it is likely that it will supply other Mexican railroads entering that city. In the Dominion of Canada the recent point of activity has been at Moncton, N. B., where a Pintsch plant will be built for supplying gas to the Intercolonial Railway. About 50 per cent. of the serviceable passenger cars belonging to the roads in the United States are now equipped with the Pintsch light, but this method of lighting was not pushed so vigorously in either Canada or Mexico as it has been in the United States, for those countries were not under control of the American Company until within a comparatively short time.

Car Heating in France.

With approach of cold weather they are again worrying about heating their cars in France. The difficulties of hot water cans and hot bricks are again pointed out. It is suggested that the cars be provided with double floors between which the heating apparatus might be placed so as to avoid the most noticeable inconveniences. But the best opinion thinks that after all they will have to resort to heating by steam from the locomotive to get satisfaction. As Yankees venture to guess that they will.

Standards and Practice in Track Work.

The Committee on Roadway of the American Railway Engineering and Maintenance of Way Association has sent out circulars asking for information. One of these circulars deals with the cross-section of roadway, covering practice with regard to formation, width of shoulders of subgrade and crowning the subgrade. Another one deals with two very important questions, viz., adjustment of grades with reference to tonnage rating and compensation of curvature. Information is sought as to the use of

momentum grades, as to the methods of fixing upon the tonnage rating, and as to the equating of empty and loaded cars. In the matter of compensation of curvature the committee asks for practice as to making the compensation directly proportional to the degree of curve or making it variable in amount per degree on different degrees of curve. Finally, an important circular asks for particulars in regard to handling material in construction by steam shovel, by unloading and spreading devices, etc. If any of our readers who are interested in these subjects are not members of this Association they may procure copies of the blanks by addressing the Secretary, Mr. L. C. Fritch, 1562 Monadnock Block, Chicago, Ill.

The Havana Paving and Sewer Contract.

The City Council of Havana by unanimous vote has awarded the contract for draining and paving the city to Michael J. Dady, of Brooklyn, N. Y., at his modified estimate of \$10,868,000. Mr. Dady has agreed to employ only Cuban laborers on the work.

Car Ferry Boat for the Pere Marquette.

The Pere Marquette Railroad will build another car ferry boat to be known as the "Pere Marquette No. 18," and it will be a duplicate of No. 17. It will cost \$400,000 and will be a twin screw ship, 350 ft. over all, with 56 ft. beam and 19 ft. 6 in. deep. It will have four tracks, with a capacity of 30 freight cars, and run between Ludington and Milwaukee.

New Dock at Port Richmond.

The Philadelphia & Reading has just opened at its Port Richmond terminal, Philadelphia, what is said to be the largest and best equipped pier in the world. It is 730 x 270 ft., with an upper floor, and divided longitudinally by a fire-proof wall. Vessels can be loaded on both sides and from both floors. Each half of each floor will accommodate the contents of 250 cars, and there is track room for 18 cars in each of these four sections. A large vessel can take on a full cargo in 48 hours. Two adjoining piers are nearly as large and another is longer and has three traveling cranes, one of which will lift 50 tons. Fifteen hundred cars are received daily in the yard adjoining these piers. Thirty or 40 vessels a month clear from Port Richmond.

THE SCRAP HEAP.

Notes.

The Louisville & Nashville has presented uniform suits of clothes to about 200 of its passenger trainmen who have been employed by the company for five years or more, and whose services have been satisfactory.

A new rule of the Rochester Street Railway Company provides that whenever a complaint is made, the complainant must deposit \$2 at the company's office, which will be returned if the complaint is decided to be just, but given to the accused employee if held to be groundless. The announcement of the rule has naturally caused much indignation.

The Lake Shore & Michigan Southern and the Chicago, Rock Island & Pacific have closed the contract with the Chicago Terminal Transfer Railroad for the use of that company's Grand Central Station, in Chicago, while the new station for the Lake Shore and the Rock Island, at Van Buren street, is being built. The present station will be vacated about Dec. 31.

A press despatch from Chicago says that the Baltimore & Ohio will soon run its passenger trains into that city over the tracks of the Pennsylvania Company, the route of which is about seven miles shorter than the line of the Chicago Terminal Transfer, over which Baltimore & Ohio trains now run. The saving in time will be 25 minutes. The Baltimore & Ohio trains will continue to use the Grand Central Passenger Station.

General Manager Mudge, of the Atchison, Topeka & Santa Fe, has issued a circular announcing a number of changes in the Brown discipline system now in use on that road. In the past, 100 demerit marks caused the discharge of the employee, but this has now been reduced to 60. Record bulletins are issued semi-monthly and will be posted at division terminals. No suspensions will be made for less than five days nor more than 30 days. Reprimands and suspensions charged against an employee's record may be cancelled as follows: A reprimand by a perfect record for three months. A suspension of 20 days by a perfect record for eight months; 30 days by a perfect record for one year. Credits for perfect service will be given only when there is a debit against the record of an employee. Credits for extraordinary service will be given at all times and will be cumulative. Thus, if an employee should have a credit of 30 days for extraordinary service and then should receive a debit of 30 days for violation of rules, his account will stand even. Unless there are mitigating circumstances, a balance of 60 demerit marks will subject an employee to dismissal.

Traffic Notes.

The Detroit & Cleveland Navigation Company will discontinue the trips of its boats on Lake Erie after Dec. 9. Some other lines will stop running about Nov. 25. The Canadian Pacific announces that lake navigation from Port Arthur and Fort William will be closed Nov. 28.

According to the *Minneapolis Times* the coal dealers of Minnesota have not secured a sufficient supply of fuel for the coming winter, by about 2,000,000 tons, so that that quantity will have to be carried into Minnesota by rail. The stock on hand at the head of the lakes is said to be 1,000,000 tons of soft coal and 250,000 tons of hard

The estimate of the demands of the winter includes the quantities which will be needed by the railroads.

On Monday, Nov. 11, the Yazoo & Mississippi Valley reported, in its daily report to the Memphis Cotton Exchange, the arrival over that road in one day of 4,535 bales of cotton, which is 480 bales more than the highest record ever before made. Including the traffic over the other two lines of the Illinois Central centering in Memphis the movement for the day, including inward and outward, amounted to 13,326 bales.

In Brooklyn, N. Y., passengers who ride to the Bridge on the elevated trains, aided by a number of industrious reporters are trying to figure out whether or not the public can afford to allow the Kings County Elevated Railroad to discontinue seven stations, driving the passengers to the surface cars, for the sake of saving time for the through passengers in the elevated trains by omitting the stops at these stations. The number of through passengers who would thus be enabled to save seven minutes a day is said to be 57,000, while the number of people patronizing the stations which it is proposed to close is less than 5,000. (The railroad company reports a single day's traffic as 4,568.) The matter is not yet settled and the company is trying to see what course will do justice to the largest number; meanwhile an enterprising mathematician has figured that the seven minutes saving daily, when properly multiplied, will aggregate five and a half centuries yearly.

In Philadelphia a large number of people are complaining because the Pennsylvania Railroad has announced that the station at Fortieth street, on the Philadelphia Division, is to be closed. Here, as at many other suburban stations, the traffic has fallen off because people have taken to riding on the street cars; and as Fortieth street is so situated that local trains stopping there often hinder the through trains the company has concluded that, in view of the small volume of business now left to it, the station should be abandoned. The Railroad Branch of the Young Men's Christian Association, which was established by the railroad company at large expense, is situated close to the Fortieth street station.

Technical Schools.

Lehigh University is building a stone laboratory, 90 ft. x 43 ft., to be used in connection with the steam engineering work of the course in Mechanical Engineering. Next fall Lehigh University will offer a new and extended course in Electro-Metallurgy—the first of its kind, it is believed, to be established in this country. The departments of Civil Engineering and of Geology have recently received valuable gifts in the shape of surveying instruments, microscopes, and geological specimens for the microscopic study of rocks.

Rensselaer Polytechnic Institute.—The Rensselaer Polytechnic Institute opens with the largest number of students in the history of the school. The new electrical laboratory is finished and equipped with 12 dynamos and motors, and six transformers are adapted for two and three-phase, working at practically any voltage between 100 and 20,000. The new laboratories for testing materials of engineering, including a finely-equipped cement testing laboratory, are in use this year, and a standard paving brick testing equipment has just been installed.

The Proposed Montreal Bridge.

The proposed bridge of the Royal Albert Bridge Co., at Montreal, Canada, is to connect the town of Longueuil with the city of Montreal, crossing the St. Lawrence River below St. Helen's Island. The bridge will have a total length of 8,800 ft. There will be a main span crossing the St. Mary's Current 1,260 ft. long and 150 ft. high. The bridge will enter Montreal near Parthenais street, elevated above the streets as far as DeMontigny street, where it reaches grade. The width of the bridge will be 83 ft., and it will provide for two railroad tracks, two tracks for electric railroads and a highway. The total weight of the steel in the structure will be 74,000,000 lbs., and there will be 90,000 yards of masonry. The cost of the bridge is estimated at \$6,000,000. It is proposed to have a union station at the corner of DeMontigny and St. Denis streets, the viaduct following the north side of DeMontigny street.

There is a charter now in force which is controlled by C. N. Armstrong, 16 St. Sacrament street, Montreal which will expire in June, 1902. A syndicate of New York and Canadian capitalists is negotiating for this charter, and to take hold of the subsidies that have been promised, viz., \$1,000,000 from the Dominion Government; \$1,000,000 from the city of Montreal; \$500,000 from the Provincial Government; \$500,000 from the counties on the south shore of the St. Lawrence, but no definite arrangement has as yet been concluded. In case this syndicate should not get control of the charter, a new charter has already been applied for with the promise that it will be granted at the next session of Parliament.

Harbor Improvements in the Canary Islands.

The Spanish Government, on Oct. 2, approved an appropriation of about \$165,000 for building and improving the mole and breakwater, and providing for the storage of water at Arcife, the capital of the island of Lanzarote, Canary Islands. These improvements, says the U. S. Consul, will increase the trade and shipping, which had fallen off on account of lack of harbor facilities.

The Naval Observatory.

The Board of Visitors to the Naval Observatory recommends that the official head of the Observatory, instead of being a naval line officer detailed to the Observatory, should be an eminent astronomer appointed by the President and confirmed by the Senate, and holding the place by as long a tenure as the Superintendent of the Coast Survey.

International Railroad Statistics.

The International Statistical Institute recently held its eighth session at Budapest. At one of the sittings the General von Wendrich, Corps of Engineers, Russian Army, made a report on the necessity for international railroad statistics. The result of the report and its discussion was that it was decided to form an international committee to collect such statistics. This committee was made up as follows: President, Yves Guyot; Vice-President, General von Wendrich; Arthur T. Hadley, (United States); Arthur Raffalovich; Blenk (Prussia); Moron; Neymarck (France); Perozzo (Italy); de Wargha (Hungary); Craigie (England). The Committee is empowered to ask for the co-operation of individuals who are not members of the International Statistical Institute.

A Newspaper Accident.

After reading, in the daily papers of Oct. 31, of an accident to a special inspection train on the Lackawanna road, in which several officers of the road were riding, we were glad to learn at first hands that none of them was injured, except that General Superintendent Clarke, when he resumed his trip, a few minutes later, was

seen to be wearing a piece of court plaster on his nose. We should not have mentioned this incident but that Mr. Clarke's injury has been noticed in many papers, including some special railroad papers, and we shall probably be doing a favor to his friends by saying that he cannot even ask for accident insurance. This episode brings up again one of the foundation rules of this office, viz., "An editor's best work is what he does not print." About half the labor expended on our monthly accident record is rejecting or modifying absurd or exaggerated stories of accidents. But we do not so much blame the reporters; they write what they can sell, and they can only sell what the editors want. The editors can stop the stream of irresponsible mendacity quickly enough if they want to.

Annual Report of the Chief of Engineers.

In the annual report of Brig. Gen. W. L. Gillespie, Chief of Engineers, U. S. A., estimates for work on rivers and harbors for the fiscal year ending June 30, 1903, are given. For local improvements to cost \$50,000 and upwards estimates are submitted for about 100 points. Among the amounts of over \$100,000 estimated for, are the following sums for different parts of the country: For the North Atlantic Coast, Massachusetts, Rhode Island and Connecticut, \$1,228,000; New York harbor and adjacent rivers, \$1,100,000; enlargement of Governor's Island, \$500,000; Middle Atlantic States, Delaware River, Potomac River at Washington, James and Cape Fear Rivers, \$1,300,000; Georgia, Florida and Alabama, \$2,000,000; Mississippi, Louisiana, Texas and Arkansas, \$1,800,000; Mississippi and Missouri Rivers in Northwestern States, \$1,375,000; Mississippi River Commission, \$3,695,000; Missouri River Commission, \$1,065,206; Cumberland and Tennessee Rivers, \$1,200,000; Monongahela River and Ohio River, including the movable dams, \$1,315,000; lake harbors and ports, including Duluth, Milwaukee, Chicago and Calumet harbors, Toledo, Buffalo, Cleveland and other lake ports, \$3,500,000; the Pacific Coast, California, Oregon and Washington, \$1,675,000. Gen. Gillespie also discusses briefly the original plan of the Endicott Board for coast defense, any says that 25 of the principal harbors of the United States now have enough heavy guns and mortars to permit of effective defense against naval attack. Provision has been made for emplacing 325 heavy guns, 327 rapid-fire guns and 376 mortars. An appropriation of \$4,000,000 is asked for more new guns and mortar batteries. During the year negotiations have proceeded for two fortification sites in Boston harbor, two at Narragansett Bay, three in New York Harbor and for sites at Port Royal, San Francisco, San Diego, St. John's River, Fort McHenry and Fort St. Philip, Va. Most of these sites must be secured by condemnation and an estimate of \$2,000,000 for sites is submitted.

LOCOMOTIVE BUILDING.

The Great Northern is asking prices on 40 10-wheel locomotives.

The Mexican Central has ordered 15 8-wheel engines at the Brooks Works.

The Araquara (Brazil) has ordered one 6-wheel locomotive at the Baldwin Works.

The Indiana, Illinois & Iowa has ordered four 6-wheel locomotives at the Baldwin Works.

Procter & Gamble, Cincinnati, have ordered one switching engine from the Baldwin Works.

The Minnesota & International has ordered two 6-wheel locomotives at the Richmond Locomotive Works.

The St. Clair Steel Company has ordered four 6-wheel locomotives at the Pittsburgh Locomotive Works.

The Atchison, Topeka & Santa Fe has ordered 120 locomotives of various types from the Baldwin Works.

The Minnesota Transfer Company has ordered one 6-wheel locomotive from the Cooke Locomotive Works.

The Colorado Springs & Cripple Creek District has ordered one 8-wheel locomotive at the Schenectady Works.

The Lake Shore & Michigan Southern has ordered 25 switch engines from the Brooks Works of the American Locomotive Co.

The New York Central & Hudson River has ordered 20 8-wheel locomotives at the Schenectady Works, and 15 6-wheelers at the Cooke Works.

The Baltimore & Ohio will place orders for 38 consolidation locomotives, 10 six-wheel shifters and two four-wheel shifters, for 1902 delivery.

The Chicago, Rock Island & Pacific has ordered 30 locomotives from the American Locomotive Co., in addition to the 30 reported Aug. 23.

The St. Paul, Minneapolis & Omaha has ordered two switching engines from the Baldwin Works, and eight engines from the Schenectady Works.

The Chicago Great Western has ordered 20 locomotives from the American Locomotive Co., Brooks Works, in addition to the 40 which they ordered recently.

CAR BUILDING.

The Central of New Jersey will order 40 coaches.

The Lehigh Valley has ordered one parlor car from the Pullman Co.

The Bayre has ordered 50 freight cars from the Laconia Car Company.

The Standard Oil Co. is building 100 tank cars at its Chicago shops.

Nelson Morris & Co. will build 100 refrigerator cars in their own shops.

The Michigan Central has ordered three dining cars from the Pullman Co.

The Atlantic Coast Line has ordered four coaches from the Pullman Company.

The Chicago & Eastern Illinois has ordered one private car from the Pullman Co.

The Boston & Maine has ordered 200 freight cars from the Laconia Car Company.

The Pennsylvania has ordered 4,500 cars from the Pressed Steel Car Company.

The Pere Marquette has ordered 20 cabooses from the American Car & Foundry Co.

The Northern Pacific has ordered 25 freight cars from the South Baltimore Car Works.

The Burlington, Cedar Rapids & Northern is building 100 freight cars at its own shops.

The Chicago, Burlington & Quincy has ordered 500 flat cars from Haskell & Barker.

The Texas & Pacific has ordered 1,500 box cars from the American Car & Foundry Co.

H. C. Pierce, of the Mexican Central, has ordered one private car from the Pullman Co.

The Denver & Rio Grande has ordered 1,500 cars from the American Car & Foundry Co.

The Anglo-American Refrigerator Line will build 100 refrigerator cars in their own shops.

The Wheeling & Lake Erie has ordered 1,500 coal cars from the American Car & Foundry Co.

The Terminal Railway Association has ordered 50 flat cars from the American Car & Foundry Co.

The San Pedro, Los Angeles & Salt Lake has ordered 50 freight cars from the Pullman Company.

The Choctaw, Oklahoma & Gulf has let 29 cabooses to the Mt. Vernon Car Mfg. Co.; also 50 flat cars.

The Blackwell, Enid & Southwestern is having four cabooses built by the Mt. Vernon Car Mfg. Co.

The American Car & Foundry Co. is building two tank cars and three coal cars for individual concerns.

The Orange & Northwestern has ordered 15 freight cars from the Georgia Car & Manufacturing Company.

The Hawkinsville, Florida & Southern is having 25 40-ft. flat cars built by the Mt. Vernon Car Mfg. Co.

Davis & Busby have ordered one freight car from the American Car & Foundry Company, at Terre Haute.

The Atchison, Topeka & Santa Fe has ordered 600 freight cars from the American Car & Foundry Co., at Detroit.

The Solway Process Company has ordered two freight cars from the American Car & Foundry Company, at Detroit.

The Bessemer & Lake Erie has ordered 1,000 hopper cars of 100,000 lbs. capacity from the Pressed Steel Car Co.

The St. Louis, Kansas City & Colorado is having 25 80,000 lbs. capacity flat cars built by the Mt. Vernon Car Mfg. Co.; also two water cars.

The Elgin, Joliet & Eastern has ordered 150 box cars of the Illinois Car Company and 400 coal cars of the American Car & Foundry Co., all of 80,000 lbs. capacity.

The Illinois Central has ordered six combination mail, baggage, and express cars from the Barney & Smith Co., and will build 12 cars with passenger equipment at its own shops at Burnside, Ill.

The Hicks Locomotive & Car Works, Chicago, have received a contract for an official car for James T. Wright, President of the Macon, Dublin & Savannah. The car is to have a capacity for eight people, and will have observation ends, and Session's steel platforms.

The Baltimore & Ohio will place orders for 4,000 steel hoppers of 100,000 lbs. capacity, 1,300 box cars of 80,000 lbs. capacity, 700 flat cars, 25 passenger coaches, 11 baggage cars, one combined baggage and coach and one combined mail and baggage car. These are for 1902 delivery.

The Minneapolis, St. Paul & Sault Ste. Marie has ordered four sleeping cars, one dining car, two mail cars, and six coaches from the Barney & Smith Co. for April delivery. The specifications include Westinghouse air-brakes, Monarch brake-beams, Washburn couplers, and the Gold Heating System.

The Rodger Ballast Car Co., Chicago, has contracted to furnish the Atchison, Topeka & Santa Fe with 600 of its new 34-ft., 40-ton convertible ballast, gondola and coal cars, to be equipped with Westinghouse air-brakes, automatic couplers, American steel body and truck bolsters, Miner tandem draft rigging and McCord journal boxes; delivery to be in January, 1902.

The Long Island has ordered 10 parlor cars, three vestibule combination cars, four combination cars not vestibuled, two baggage and mail cars and 10 60-ft. baggage and express cars from the Pullman Co. Also 12 vestibule coaches and 20 coaches not vestibuled, from the American Car & Foundry Co. This order was reported last week without the names of the contracting firms.

The Lake Erie, Alliance & Wheeling has ordered nine passenger cars and 100 flat cars from the American Car & Foundry Co., for March and April delivery. The passenger cars will be 52 ft. long and have Westinghouse air-brakes, Tower couplers, Pantasote curtains and upholstery, Harrison dust guards, Standard steel platforms, and a direct system of steam heat. The flat cars will be of 60,000 lbs. capacity and be 36 ft. long and 8 ft. 9 in. wide. The special equipment includes: Westinghouse air-brakes, Buckeye couplers, and Harrison dust guards.

BRIDGE BUILDING.

BANGOR, ME.—Negotiations are under way to build a new superstructure on the present piers and abutments of the bridge between Bangor and Brewer.

BELLEVUE, KY.—The Town Councils of Bellevue and Newport are considering plans for a viaduct across Taylor Mill Bottoms to connect the two cities. It is said that as soon as plans are decided on, bids will be advertised for.

BENNINGTON, VT.—The Rutland R. R., in the near future, will build a new steel bridge over the outlet from Lake Param, between North Bennington and Bennington.

BIRMINGHAM, ALA.—The City of Birmingham, according to report, has authorized the Southern Ry. to build a bridge over one of the streets in the city.

BOISE, IDAHO.—Bids are wanted, Dec. 16, by the County Commissioners for a combination steel and wooden bridge over Boise River at Eagle Island. J. W. Wick-ersham, County Clerk.

BRADY'S BEND, PA.—Edward Wilkins Dewey, of this place, writes us that he has offered the Commissioners of Armstrong and Clarion counties to build a combination railroad and highway bridge over the Allegheny River between Brady's Bend and East Brady.

BRIDGEPORT, CONN.—The New York, New Haven & Hartford, according to report, will receive bids, until Dec. 1, for the Scherzer rolling lift bridge over Pequonnock River, to consist of two parallel double-track bridges.

CAMDEN, N. J.—Plans and specifications for the new bridge over Cooper's Creek, at Baird avenue, have been sent to the War Department for approval.

CHAMPAIGN, ILL.—The bridge committee of the Board of Supervisors is considering a site for a new bridge across Sangamon River at Houstonville.

CINCINNATI, O.—Eugene L. Lewis, County Auditor, will receive bids on Dec. 7 for a steel truss bridge over Muddy Creek on Delhi Pike.

CROWLEY, LA.—The Police Jury has appropriated \$2,500 for a bridge across Desbaunes River.

DANVILLE, ILL.—The Big Four will begin work in the spring, according to report, on the bridge proposed over the North Fork on the Peoria Division, which will be 179 ft. long and cost about \$100,000.

DENVER, COLO.—A bridge will be built over Bijou Creek about three miles west of Fort Morgan.

DULUTH, MINN.—The Duluth Canal Bridge Co., which was formed to build the aerial bridge over the ship canal, has awarded a contract to Hugo & Tims, of Duluth, for the substructure. The American Bridge Co. has the contract for the superstructure of this bridge, which was described and illustrated in the *Railroad Gazette* in January, 1900.

GLASSPORT, PA.—J. A. Pierce, Charles H. Kline and others of McKeesport, are interested in the West Elizabeth & Dravosburg Bridge Co., which proposes to bridge Monongahela River at Glassport.

GONZALES, TEX.—The Commissioners Court of Gonzales County will receive bids on Nov. 25 for a steel bridge across the San Marcos River, two miles from this city. W. W. Glass, County Judge.

FINDLAY, OHIO.—There is no truth in the report that the Lake Erie & Western will build a bridge over Blanchard River.

GLENDON, PA.—A bridge is proposed over Lehigh River and H. J. Miller, Upper Mt. Bethel, is a member of the Board of Viewers considering a site.

GRAY'S POINT, MO.—It is said that steps have been taken toward designing the bridge to cross the Mississippi between Gray's Point and Thebes.

GRAND HAVEN, MICH.—The Grand River Toll Bridge Co. has been incorporated in Michigan to build a toll bridge between Grand Haven and Spring Lake, over Grand River.

GREENFIELD, IND.—Bids are wanted, Dec. 7, for a number of county bridges. R. G. Wilson, County Commissioner.

GREENFIELD, MO.—W. H. Van Hooser, County Clerk, Dadeville, will let a contract, on Dec. 2, for a steel bridge over Horse Creek.

GUADALAJARA, MEXICO.—V. Garcia Juentes, of this city, is reported in the United States for the purpose of placing contracts for structural material for railroad bridges in Mexico.

JAMESTOWN, N. Y.—According to report, the next Legislature will be petitioned to have the State pay for the proposed bridge across Chautauqua Lake, which will probably be 800 or 900 ft. long.

HOLYOKE, MASS.—A committee is considering plans for a new bridge at Sargent street and will report to the next meeting of the Board of Aldermen. The City Engineer is a member of the committee.

LAFAYETTE, IND.—Plans are being made for a new bridge in place of the Brown street bridge. The new structure will be about 582 ft. long and probably of five spans, the width of the roadway being 20 ft. Wallace Marshall and Melville W. Miller are making the plans.

LEECBURG, PA.—Two bridges will be built across Kiskiminetas River, one at Hyde Park and another at Apollo by the Leechburg & Apollo Street Railway. Alfred Hicks, President.

LITTLE FALLS, MINN.—The county officers and the City Council are considering the cost of a new bridge at Broadway over the Mississippi. The Northern Pacific will probably pay part of the cost.

LYNN, MASS.—City Engineer Leland has submitted a report to the city officers suggesting five different plans for abolishing the grade crossings of the Boston & Maine R. R. (See Railroad Construction column.)

MCDERMOTT, OHIO.—The County Auditor will receive bids, until Dec. 10, at Portsmouth, for a 130-ft. bridge over Scioto Brush Creek, bidders to supply their own plans. Lafayette Jones, County Surveyor.

MANASSAS, VA.—Bids are wanted, Nov. 28, according to report, for a steel bridge 110 ft. long at Milford Mills.

MARION, IND.—Blackford and Grant counties will build a bridge on the county line at the crossing of Walnut Creek.

NEW CASTLE, PA.—Viewers are appointed by the County Court to consider a site for a new bridge to be built over Shenango River. The bridge will probably cost \$85,000.

NEWPORT, R. I.—The New York, New Haven & Hartford has submitted a plan to the city of Newport to abolish the grade crossings in that city.

NEW YORK, N. Y.—The Department of Bridges wants bids, until Dec. 5, for a Scherzer rolling liftbridge over Newtown Creek, with viaduct approaches on Vernon and Manhattan avenues.

NORTH WALES, PA.—The borough has authorized a bridge built over the Reading R. R. tracks in North Wales. Bids will be wanted soon, according to report.

PITTSBURGH, PA.—The City Controller will receive bids on Nov. 23 for a steel footbridge over the B. & O. tracks at Melancthon street. Edward M. Bigelow, Director of Public Works.

It is quite probable that the contracts for the South Tenth street bridge over Monongahela River, the Wilmet street bridge and the Lincoln avenue bridge, the total cost of which will be \$540,000, will be let soon. The funds are available.

PORTLAND, N. Y.—The State Railroad Commissioners have authorized the Pennsylvania R. R. to change the crossing of the Western New York & Pennsylvania at the Main Road crossing in this town.

RUTLAND, VT.—The Rutland R. R., according to report, will rebuild the wooden bridges with steel structures on the line of the Chatham & Lebanon Valley.

SCRANTON, PA.—John E. Roche, Director of the Department of Public Works, tells us that no steps have been taken to get plans and specifications made for bridges as has been reported. The Board is considering the question of some new bridges, namely, over Roaring Brook, at Cedar Avenue, and over the Lackawanna River at Race street, but nothing will be done until some time in February.

SEWAREN, N. J.—The New Jersey Terminal Railroad is authorized to cross the tracks of the Central Railroad of New Jersey between Cartaret and Sewaren on a bridge 22 ft. high.

TIVERTON, R. I.—A bill is before the Rhode Island Legislature to build a drawbridge in place of the old Tiverton stone bridge. The bill appropriates \$100,000 for the bridge and also authorizes a commission to build a temporary bridge while the new bridge is building.

WASHINGTON, D. C.—The Pennsylvania Railroad has let a contract for the foundation and substructure of its new bridge across the Potomac at Washington, to Weand & McDermott, of Philadelphia. Work is to be begun soon and it is expected to be finished in about a year. The new bridge is to take the place of the Long Bridge. There

will be 11 piers and one draw span pier, separated a distance of from 170 to 216 ft.

WEST SENeca, N. Y.—The Buffalo, Rochester & Pittsburgh is granted permission by the Railroad Commissioners to build a plate girder bridge, without supports between abutments, on its road where it crosses the White's Corners road or South Park avenue in West Seneca.

WINSTON-SALEM, N. C.—The county officers are considering building a new bridge over Muddy Creek five miles northwest of Winston. They are also considering rebuilding a number of wooden bridges in the county with steel structures.

Other Structures.

ALLENTOWN, PA.—According to a despatch from Allentown, the furnace of the Lehigh Steel & Iron Co., at Aineyville, will be overhauled and blown in.

BUFFALO, N. Y.—The Taylor Signal Co. tells us they contemplate building a new plant to be located on Elmwood avenue, at its crossing of the New York Central & Hudson River R. R. Belt Line tracks. The plans are not yet sufficiently developed, but the intention is to have two buildings, 50 x 205 ft., with a 2-story wing 50 x 50 ft. The offices and engineering department are to be in a separate building, two stories high, 55 x 40 ft.

CLEVELAND, OHIO.—It was recently reported that a large steel works would be built by people identified with the Union Rolling Mill, the Wellman-Seaver Engineering Co., and the Oglebay-Norton Co. This report is erroneous, but a company is being formed to build, in Cleveland, a large blast furnace to make foundry iron at the rate of about 300 tons per day. The promoters will also build a plant to make their own coke. The entire outlay will be about \$2,000,000.

COLUMBIA, PA.—According to report, several officers of the Susquehanna Iron & Steel Co., and others, have decided to build a pipe mill and a rolling mill in Columbia at a cost of about \$100,000. It will probably become a part of the Susquehanna Iron & Steel Co.

CUMBERLAND, MD.—Alfred F. Baumgarten, of Pittsburgh, Pa., has bought the mill of the Crucible Steel Co. of America in South Cumberland and will operate it as the Maryland Sheet & Steel Co. to make plates, bars, and light section rails.

ENGLAND.—The J. G. Brill Co., of Philadelphia, Pa., is reported to have selected Preston, Lancashire, as the site for its projected British plant. The works will, it is stated, employ about 500 men and will have a capacity of 1,000 cars and 4,000 trucks annually.

FORT WAYNE, IND.—The New York, Chicago & St. Louis, according to report, will place a new 65-ft. turntable at its roundhouse in Fort Wayne, and will also rebuild the roundhouse.

FRANKLIN, PA.—The Franklin Steel Casting Co. is building an addition to its plant which will be 328 x 106 ft. and 90 ft. high. The approximate cost is \$75,000. The work, which is being done by the Fort Pitt Bridge Works, is nearly finished. A gas producer and a 15-ton open-hearth furnace will also be built. When these additions are finished, the capacity of the plant for making steel castings will have been increased more than 50 per cent.

GALVESTON, TEXAS.—A report says that the Southern Pacific has asked bids for the new grain elevator about to be built in Galveston. The foundations of this structure, which will occupy about 32,000 sq. ft. of ground, will be of concrete and cost about \$100,000. The bids for the concrete work will be opened at the office of the architect in Chicago in a few days.

HOUGHTON, MICH.—The Duluth, South Shore & Atlantic will, next spring, build a new station here. It will be 80 x 30 ft., and cost about \$15,000.

JACKSON, MICH.—The Michigan Central has recently let a contract to George B. Swift Co., of Chicago, Ill., for additions to the present shops in Jackson. The addition will be 360 ft. long and 140 ft. wide. A power house will be built and power will be conveyed to the new part of the shop and to the old shop. The shops will be lighted by electricity, as will also the station at Jackson and the various freight houses in the vicinity.

NATAL, SOUTH AFRICA.—According to report, plans are under consideration for the development of the port of Natal. It is said four miles of wharves will be built; also a short line of railroad. Considerable dredging will be done.

NEW YORK, N. Y.—Bids were opened at the office of the Supervising Architect of the Treasury Department, Washington, D. C., Nov. 7, for the superstructure of the new Custom House building in New York. The following are the bids: D. C. Hayes Co., Chicago—For Milford granite, \$2,391,293; for limestone, \$2,176,000. Isaac A. Hopper & Son, of New York—Of approved granite, \$3,000,000. John C. Rodgers, New York—Clark Island granite, \$2,092,000; Deer Island granite, \$2,030,000. P. J. Carlin & Co., Brooklyn—Somes Sound granite, \$2,227,776; Blue Hill or Green Isle granite, \$2,319,632. Norcross Bros., New York—Bradford granite, \$2,284,000; light gray granite, \$2,284,000; Georgia white marble, \$2,384,000. W. A. & E. Wells, Chicago—Limestone, \$1,929,535. John Griffiths & Son, Chicago—Somes Sound granite, \$2,295,000. John Pierce, New York—Fox Island granite, \$2,187,000; Stony Creek granite, \$2,287,000; Jonesboro granite, \$2,387,000.

A 19-story hotel will be built at the west side of Park avenue from Forty-first to Forty-second streets. It is on the site of the station on the underground railroad and is being built by the Subway Realty Co., at a cost of about \$2,500,000.

OMAHA, NEB.—An officer of the Union Pacific writes under date of Nov. 11 that contracts have not been placed for the shop buildings at Omaha, Neb., and Pocahontas, Idaho, but the company expects to have them placed within a short time. A day or two ago it was reported that the railroad company had made an agreement with the city by which the company is permitted to make improvements to the extent of about \$2,000,000. The shops, which will be built in this city, will cost about \$750,000.

PITTSBURGH, PA.—Plans are being made by the Carnegie Steel Co. for a large angle plant which will adjoin the Howard Axle Works. The mill will roll angles from 3 x 3 in. up to 8 x 8 in., and will have a capacity of 12,000 tons a month.

POCATELLO, IDAHO.—See Omaha, Neb.

PORTLAND, ORE.—An officer of the Northern Pacific Terminal Co. writes that there is considerable low land to be filled in before anything can be done toward building the proposed train shed. The work will probably be begun in the spring.

RATON, N. MEX.—An officer of the Atchison, Topeka & Santa Fe writes that plans are still under consideration for the projected passenger and freight depot in Raton, and that work will probably not be begun until next year.

SAN ANTONIO, TEX.—Both the Southern Pacific and the International & Great Northern railroads contemplate building passenger stations here. The Southern Pacific has recently begun work on its station, but the International & Great Northern, we are told, has not yet let the contract.

SAULT STE. MARIE, MICH.—The \$1,000,000 steel tube works of the Clergue Syndicate, which were to be built on the Canadian side of the "Soo," will be built on the American side instead. Orders for machinery have been placed and the work will be begun soon.

SCRANTON, PA.—An officer of the Delaware, Lackawanna & Western writes that the company is now enlarging the roundhouse at Scranton to accommodate the larger equipment. The company contemplates, next year, building a new freight station in Scranton and rearranging the yard facilities generally. More comprehensive plans for changes in the shops, etc., have been planned, but they will not be carried out until the beginning of 1903.

SYRACUSE, IND.—The Sandusky Portland Cement Co., Sandusky, Ohio, tells us that they will put in, this winter, eight rotary kilns, in addition to the six now running at their Syracuse plant. This addition, with the necessary machinery, will make the output of the mill at least 2,000 barrels a day. A few of the contracts for material have been let. The bulk of the machinery will, however, be of type already decided upon and no competitive bids will be asked.

TACOMA, WASH.—The Tacoma Rolling Mills will build another extension to its plant.

TERRE HAUTE, IND.—Plans for doubling the size of the Vandalia freight depot at Tenth street and Wabash avenue have been decided upon and work will soon be begun. An addition 400 ft. long will be built on the north of the present depot, making it 800 ft. long.

MEETINGS AND ANNOUNCEMENTS.

(For dates of conventions and regular meetings of railroad associations and engineering societies see advertising page xvii.)

Canadian Society of Civil Engineers.

At the meeting held on Thursday evening of this week Mr. F. P. Shearwood read a paper on "The Superstructure of the Interprovincial Bridge at Ottawa."

American Association of Traveling Passenger Agents.

This Association held its annual meeting at Los Angeles, Cal., Nov. 12 and 13. The President for the ensuing year is Mr. John C. Clair, of Boston, New England Agent of the Illinois Central.

New York Railroad Club.

At the regular meeting, held on Thursday evening of this week, Mr. F. J. Cole, Assistant Mechanical Engineer of the American Locomotive Co., presented a paper on "Recent Locomotive Construction and Performance."

Rocky Mountain Railway Club.

At the meeting of the Club, held on Nov. 16, in Denver, Colo., the paper for discussion was "Boiler Washing With Cold Water." The topical discussion was "Notes on the Conventions," by A. L. Humphreys, of the Colorado & Southern. Mr. G. W. Rhodes, Assistant General Superintendent of the Burlington & Missouri R. R., told of his recent observations in England.

Western Society of Engineers.

The Western Society of Engineers held a special meeting in its rooms, Monadnock Block, Chicago, Wednesday evening, Nov. 20. Prof. W. D. Pence, of Purdue University, presented a paper on "The Coefficient of Expansion of Concrete." Mr. W. H. Finley, Principal Assistant Engineer of the Chicago & Northwestern, presented a paper entitled, "Some Notes on the Protection of Metal Work of Ballasted Bridge Floors."

American Society of Civil Engineers.

At the meeting of the Society on Wednesday evening of this week there were presented two papers, as follows: "The Water Works of Guantanamo, Cuba," by S. D. Rockenbach, postponed from the last meeting, and "A Graphical Method for the Solution of Stresses in the Continuous Girder, as Applied to Drawbridges," by George F. Barton. These papers were printed in the September and October proceedings, respectively.

Central Railway Club.

At the meeting held in Buffalo, Nov. 8, Mr. John Player, Mechanical Engineer, Brooks Locomotive Works, Dunkirk, N. Y., read a paper on locomotive piston valves. There was a general discussion on the subject. The next meeting will be held at the Iroquois Hotel, Buffalo, on the second Friday in January. Two subjects are assigned for this meeting, as follows:

"Best Improvements in Boiler Design and Best Proportion of Heating and Grate Service for Different Kinds of Coal," and "Best Method and Shop Practice of Meeting the Requirements for the Manufacture of all Steel Cars."

The first subject is assigned to a committee consisting of Charles M. Hogan and John Moore, of Buffalo, and H. A. Ferguson, of Williamsport.

The second subject is assigned to a committee, of which G. N. Dow, of Cleveland, is the chairman.

The January meeting will be the annual meeting of the club, and the annual election of officers will take place. Nominations will be presented to the meeting by a committee consisting of John S. Lentz, G. N. Dow, A. C. Robson, John Mackenzie and L. T. Canfield.

Engineers' Club of St. Louis.

The 532nd meeting was held Nov. 6, President Spencer presiding. Mr. Kinealy, for the executive committee, made a report regarding down-town quarters, repeating the report made at the last meeting, and also giving additional information regarding the cost of furnishing the new quarters. After considerable discussion a motion was made by Mr. Bryan, which was amended by Mr. Flad; the amended motion was as follows: "That the recommendation of the executive committee in the matter of securing down-town quarters in association with the St. Louis Chapter of the American Institute of Architects and the St. Louis Architectural Club be approved, and that the executive committee be authorized to arrange all necessary details." This motion was carried.

Owing to the unavoidable absence from the city of Mr. H. H. Humphrey, who was to have read a paper on "Uses of Beaumont Oil," Mr. Alex. S. Langsdorf addressed the club on the subject of "Iron in Alternating Current Circuits." He discussed the curves of magnetism, loops due to hysteresis, and described a simple method of obtaining the co-efficient of self-induction. Discussion was

participated in by Messrs. Kinealy, Klauder and Langsdorf.

American Society of Mechanical Engineers.

The 44th meeting of the American Society of Mechanical Engineers will be held in New York city, Dec. 3 to 6. The opening session will be at 9 p. m., Tuesday evening, the 3rd, when the President, Mr. Samuel T. Wellman, will deliver the presidential address on "Early History of Open-hearth Steel Manufacturing in the United States." On Wednesday morning there will be a business session and a topical discussion of professional subjects. The afternoon is left free and in the evening there will be a reception at Sherry's, 44th street and Fifth avenue. On Thursday morning there will be a session for presentation of professional papers, and the afternoon will be given to the dedication of a memorial to Robert Fulton, with addresses by Rear-Admiral Melville, U. S. N., Chief Engineer Isherwood, U. S. N., and Dr. R. H. Thurston. A religious service will be held in Trinity Church. The monument is erected in Trinity Churchyard. Thursday evening and Friday morning professional sessions will be held. A list of topics and papers to be presented at the various sessions is appended.

Topical Discussions.

Cost of Running Trains at High Speeds; Some Peculiarities of Springs; The Lincolnton System of Units.

Professional Papers.

Corey, F. B., "A Portable Accelerometer for Railway Testing."
Gantt, H. L., "A Bonus System of Rewarding Labor."
Nixon, J. O., "A Silent Chain Gear."
Benjamin, C. H., "The Bursting of Small Cast-Iron Fly-Wheels."
Preliminary Report of the Committee appointed to codify and standardize the methods of making Engine Tests.
Report of the Committee on Standardization of Engines and Dynamos.
Naylor, E. W., "A New Valve Gear for Gas, Steam and Air Engines."
Scheffer, F. A., "The Potter Mesh Separator."
Hunt, C. W., "Working Loads for Manila Ropes."
Lucke, C. H., "The Heat Engine Problem."
Benjamin, C. H., and R. A. French, "Experiments on Spiral Springs."
Johnson, W. C., "Water Power Development at Hannawa Falls."
Warner, W. R., "The Porro Prism."
Kingsbury, Albert, "Effect of Clearance on the Economy of a Small Engine."

Engineers' Club of Philadelphia.

A regular meeting of the Club was held on Saturday, Nov. 16, 1901, at 8 o'clock, p. m. The papers were: "The Economical Conversion and Transmission of Energy," illustrated, by W. C. L. Eglin; and "Notes Upon an Electrical Tide Indicator," illustrated, by L. Y. Schermerhorn.

At the meeting held Nov. 2 a topical discussion upon the needs of industrial education in America was opened by Prof. Edgar Marburg, who presented a paper upon the "Needs of Industrial Education with Reference to the Schools." He defined industrial education as being preparatory, more or less directly, to the manual practice of the useful arts. While the present provision for higher technical education to-day leaves little to be desired, systematic industrial education has been almost wholly neglected. Manual training schools are not trade schools, and consequently cannot be expected to fill this need.

Mr. Samuel M. Vaulain followed with a paper on the "Needs of Industrial Education with Reference to the Machine Trade," especially for the education of apprentices. He recommended that when our youth have left school and stand ready to enter upon their life's work, there should be a well-defined and improved system of indenture pursued by the owners of all industries to meet the various grades of boys seeking places. Those who have had less general education should be instructed in the shops for a longer term of service than those who have had a high school or collegiate training. He believed that the money now spent by the various trade schools should be devoted to a thorough teaching of mathematics and mechanical drawing, and perhaps chemistry and mechanics, while the shops of our nation could be organized into mechanical training schools already thoroughly equipped with teachers and machinery far more valuable than those now employed. He briefly described what is being done in this direction by the Baldwin Locomotive Works of Philadelphia, and pointed out that it would be better for every manufacturer to entrust his business to a competent stranger educated under his own roof than to an irresponsible and disinterested progeny.

Mr. John M. Shrigley presented the third paper, in which he treated the subject, "With Reference to the Building Trades." He described the work which is being done at the Williamson Trade School, under his charge, to instruct young men in mechanical drawing and the scientific principles underlying the various trades concerned in building construction. The old-fashioned apprenticeship method is a somewhat tedious process which can be surpassed in a well-conducted trade school, having a systematic and well-graded course of instructional exercises under competent teachers.

PERSONAL.

(For other personal mention see Elections and Appointments.)

—Mr. Charles S. Bihler, who recently resigned as Division Engineer of the Northern Pacific, will open an office as Consulting Engineer at Tacoma, Wash.

—Mr. B. S. Sutton, at one time Superintendent of the White Water Division of the Cleveland, Cincinnati, Chicago & St. Louis, died Nov. 12. Mr. Sutton was, previous to taking this position, General Agent of the Chesapeake & Ohio at Ashland, Ky.

—Mr. Frank T. Hyndman, who, since Nov. 1, has been Division Master Mechanic of the Baltimore & Ohio, with jurisdiction over the Pittsburgh & Western, began his railroad career as a machinist at Ashley, Pa., on the Central Railroad of New Jersey. In 1895 he became Trainmaster of the Pittsburgh & Western, and the following year Master Mechanic. Mr. Hyndman was born Sept. 29, 1858.

—Mr. Fred E. Place, who succeeded his father as Division Master Mechanic of the Illinois Central, on Nov. 1, last, was born Aug. 4, 1868, and entered railroad service in 1884 as a clerk in the Master Mechanic's office of the Illinois Central, and has served continuously with this company ever since. In 1887 he became a machinist, then acting foreman, and in 1895 was promoted to be General Foreman of the Burnside shops at Chicago.

—Mr. Ashbel Green, up to very recently Purchasing Agent of the Manhattan Railway Company, has severed his connection with that company and has identified himself

with the Thornton N. Motley Company, and assumes the position of Treasurer upon the resignation of Mr. W. W. Caldwell. Mr. Green is a Yale graduate and has been connected with the West Shore and the New York Central Railroads, as well as the Manhattan Elevated Railroad.

—The railroad experience of Mr. R. F. Watkins, the new Superintendent of Car Service of the Colorado & Southern, began in 1894, when he started in the office of the Auditor of the Union Pacific, Denver & Gulf, one of the predecessor companies of the Colorado & Southern. After serving at almost every desk he became Chief Clerk of the disbursement department and remained in that position from 1896 to June, 1900, when he was appointed Chief Clerk to the General Auditor. Mr. Watkins is 31 years old, having been born in Davenport, Iowa, Oct. 13, 1870.

—Mr. T. H. Symington, who was, until recently, Superintendent of Motive Power of the Atlantic Coast Line Railroad, and later President of T. H. Symington & Co., of Baltimore, has accepted a position as representative of the Gold Car Heating Company, of New York and Chicago. Mr. Symington, who is a graduate of Johns Hopkins University, and who took the degree of Mechanical Engineer from the Lehigh University, had a number of years' practical experience in the shops and mechanical department of the Baltimore & Ohio Railroad. He left the Baltimore & Ohio to become Assistant Superintendent and General Sales Agent of the Richmond Locomotive Works, and later was for four years Superintendent of Motive Power of the Atlantic Coast Line.

—Mr. J. M. Daly, formerly Superintendent of Transportation of the Delaware, Lackawanna & Western, and who has recently been engaged in special service on the Intercolonial, has been appointed General Manager of the Cape Breton Railway Extension, with headquarters at Hawkesbury, N. S. Mr. Daly is well known to the readers of the *Railroad Gazette* through his connection with the Car Accountants' Association. He was in the car record office of certain western roads from 1883 to 1892, the latter part of this time on the Illinois Central; and in September of the last-named year he was appointed Superintendent of Transportation of the Illinois Central. He held this position for seven years, and then (May 1, 1899) took a similar position on the Delaware, Lackawanna & Western, which he left a few months ago.

—Mr. William Durham Sargent has been elected President of the National Founders' Association. He is President of the American Brake Shoe Co., and President of the Sargent Company, iron and steel founders, Chicago. He was born in 1864 in Massachusetts, educated at the Northwestern University, Evanston, Ill., and the Institute of Technology, Boston. He was for some time with the Pullman Company, and also with the Ramapo Iron Works, at Hillburn, N. Y., after which he became the foreman in the foundry of the Congdon Brake Shoe Co., of Chicago, later becoming Superintendent and finally General Manager of the Sargent Company, which succeeded the Congdon Brake Shoe Company in 1893. Mr. Sargent has been one of the foremost manufacturers of cast steel and has built up a large business in basic open-hearth steel castings, as well as having made a success of the Tropenas steel casting process in this country at the Chicago Heights plant of the Sargent Company. He is the inventor of numerous improvements in brake-shoes.

—Mr. William McMillan, Chairman of the Board of Directors of the American Car & Foundry Company, died at his home in St. Louis, Mo., of pneumonia, Friday, Nov. 15, after a very short illness. He went to St. Louis over 30 years ago and has been prominently identified with the social and business interests of that city ever since. He was best known in business through his connection with the Missouri Car & Foundry Company, of which concern he was the President for many years. On the consolidation of this company with the American Car & Foundry Company Mr. McMillan became Chairman of the Board of Directors of the latter company and was actively engaged in business to within a few days of his death. He was also a member of several clubs and was well known for his philanthropic work, having given largely to Washington University and other educational institutions. It has been said that the surest way to obtain help from him was to assure him that no mention of his generosity would be made. Mr. McMillan was born in Canada, Dec. 20, 1841, and was a brother of United States Senator James McMillan, of Detroit, Mich.

ELECTIONS AND APPOINTMENTS.

Atchison, Topeka & Santa Fe.—H. Giegoldt has been appointed Division Master Mechanic, with headquarters at La Junta, Colo., succeeding C. M. Taylor, transferred.

Baltimore & Ohio.—T. J. English, heretofore Superintendent of the Middle Division at Newark, Ohio, has been appointed Superintendent of the Pittsburgh Division, succeeding J. Barron, resigned.

Bessemer & Lake Erie.—G. W. Kepler has been elected Secretary and Treasurer.

Buffalo & Susquehanna.—W. H. Baumes has been appointed Auditor, with headquarters at Buffalo, N. Y., succeeding the late Mr. Freeborn.

Cape Breton Railway Extension.—J. M. Daly has been appointed General Manager, with headquarters at Hawkesbury, N. S.

Chicago & Alton.—W. H. Starr, heretofore Superintendent of the Western Division, is to become Superintendent of Construction, with headquarters at Chicago, Ill., and W. B. Taylor, Engineer Maintenance of Way, George L. Moore has been appointed Engineer Maintenance of Way of the Eastern Division, succeeding J. R. W. Davis. (See Erie.)

Dallas, Fort Worth & Gulf.—F. C. Fogarty has been appointed Auditor, with headquarters at Dallas, Texas.

Evansville & Terre Haute.—J. G. Metcalfe, heretofore General Manager of the Denver & Rio Grande, has been appointed General Manager of the E. & T. H., with headquarters at Evansville, Ind.

Erie.—J. R. W. Davis, heretofore Engineer Maintenance of Way of the Chicago & Alton, has been appointed Engineer Maintenance of Way of the Erie, succeeding George Sergeant, Jr., resigned.

The headquarters of C. C. Reynolds have been removed from Chicago, Ill., to Huntington, Ind.

Hoaxie, Pocahontas & Northern.—The following appointments have been announced: E. F. Blomeyer, Assistant to President (N. Erb) and Traffic Manager; Van R. Caldwell, Purchasing Agent; J. C. Fisher, Master Mechanic, all with headquarters at Cape Girardeau, Mo.; and J. L. Reinach, Superintendent, with headquarters at Walnut Ridge, Ark.

Intercolonial.—The office of General Superintendent is discontinued and the duties of that office will be discharged by the Manager and his Assistant. J. E.

Price, heretofore General Superintendent, has been appointed Superintendent of the Moncton and Ste. Flavie District, with headquarters at Campbellton, N. B., succeeding W. Rennels, deceased.

Intercolonial of Mexico.—W. J. Morkill has been appointed General Manager, with headquarters at Mexico, Mex., succeeding G. M. Stewart, resigned.

Kingston & Pembroke (Canadian Pacific).—The property of this company having passed under the control of the C. P., H. Folger has been elected President, succeeding C. F. Gildersleeve, resigned, and C. W. Spencer, General Superintendent of the Eastern Division of the C. P., becomes Vice-President and General Manager of the K. & P., succeeding B. W. Folger, General Manager, resigned.

Marietta, Columbus & Cleveland.—E. E. Finch has been appointed General Freight and Passenger Agent, with headquarters at Marietta, Ohio, succeeding L. W. James, resigned.

Northern Securities Company.—The officers of this company are: President, James J. Hill; Vice-President, John S. Kennedy; Second Vice-President, George F. Baker; Third Vice-President, D. Willis James; Fourth Vice-President and General Counsel, W. P. Clough; and Secretary and Treasurer, E. T. Nichols. The Directors, including the above-mentioned, are: Samuel Thorne, Robert Bacon, George W. Perkins, E. H. Harriman, Jacob H. Schiff, James Stillman, George C. Clark, Daniel S. Lamont and N. Terhune. (See R. R. News column.)

Orange & Northwestern.—C. W. Hole, heretofore General Freight and Passenger Agent of the Kansas City, Watkins & Gulf, has been appointed General Manager of the O. & N. W.

Pittsburgh & Lake Erie.—J. W. Riley has been appointed Superintendent of the Pittsburgh & Lake Erie Division, including Pittsburgh Yard, First and Second Divisions, with headquarters at Pittsburgh, Pa. G. B. Obey becomes Superintendent of the Youghiogheny and Monongahela Divisions, at Pittsburgh, Pa., both reporting to the General Superintendent.

Queen & Crescent.—L. W. Stubbs, Resident Engineer of the Alabama & Vicksburg at Vicksburg, Miss., has resigned.

St. Louis, Iron Mountain & Southern (Missouri Pacific).—R. P. Dalton, heretofore Superintendent of Terminals, has been appointed Superintendent of the Valley Division, with headquarters at Mer Rouge, La., succeeding F. B. DeGarmo. Mr. Dalton is succeeded by H. H. Brewer.

San Antonio & Aransas Pass.—William D. Cornish has been elected President, succeeding T. E. Stillman.

Tennessee Central.—The headquarters of E. A. Faulhaber, Treasurer and Purchasing Agent, have been removed from St. Louis, Mo., to Nashville, Tenn.

Tennessee Coal, Iron & Railroad.—N. Baxter, Jr., President, has resigned.

Virginia & Southwestern.—William N. Morgan has been appointed Purchasing Agent, with headquarters at Bristol, Tenn., succeeding John Warwick.

RAILROAD CONSTRUCTION.

New Incorporations, Surveys, Etc.

AVA NORTHERN.—The plans of the directors of this proposed line from Ava, in Douglas County, Mo., to Cedar Gap, in Wright County, 14 miles, have been changed and it is now proposed to equip the road with steam instead of electricity, as previously intended. (Oct. 25, p. 746.)

BOSTON & MAINE.—A report containing five plans for eliminating the grade crossings in Lynn has been presented to the City Council by the City Engineer. Under any one of the five plans a very radical change will be necessary, involving either an embankment or an extensive cut with a number of bridges.

BRITISH COLUMBIA ROADS.—Application is being made to the Legislature of British Columbia for an act to incorporate a company to build a railroad from a point at or near Hazelton, on the Skeena River in the District of Cassiar, B. C., to a point on the boundary line of the province at or near Teslin Lake or Atlin Lake, or both; also from Hazelton to a point at or near the eastern boundary of the province by way of the Skeena, Babine, Driftwood, Omineca and Finlay Rivers to the Peace River Pass and thence eastward. This projected route involves a line north 350 miles through hitherto unexplored territory for part of the distance, and a line east for 150 miles.

It is reported that work on the new line from Kitemat Arm, B. C., into the interior, will be begun next spring. The preliminary surveying party has returned with the report that the country is easy. It is the intention of the projectors to start next year the line from Kitemat Arm to the canyon on the Skeena, 40 miles, where there are large copper properties, and it is said that no grades heavier than 1 per cent. will be encountered. The next portion of the line to be built is from the canyon to Hazelton, a distance of about 85 miles.

CANADIAN PACIFIC.—It is announced that a new line is to be built from Saskatoon, Man., west.

CHICAGO, ROCK ISLAND & PACIFIC.—Two surveys are reported for the projected Kansas City cut-off, one from Drakeville, Iowa, to Trenton, Mo., 80 miles, and one from a point near Floris, Iowa, to Trenton, Mo., 88 miles. As soon as it is decided which route will be selected, it is said that contracts will be let. (Nov. 8, p. 782.)

CUMMING & BUFORD ELECTRIC.—A new line to connect the towns named in Georgia is being promoted by R. J. Owens, of Buford, and R. W. Shadburn, of Cumming, Ga. The company is to be capitalized at \$500,000 and expects to obtain power from the Chattahoochee River. The distance from Cumming to Buford is about 11 miles.

DES MOINES, IOWA FALLS & NORTHERN.—The proposition to vote a 2½ per cent. tax in aid of the construction of this line from Des Moines to Iowa Falls was carried by a vote of 303 to 17 at a special election held in the city of Nevada, Story county, Iowa, Nov. 11. In addition to this tax the citizens of Nevada have also agreed to make a gift of the right of way through Nevada township to the company. Grading on the line has been completed south from Iowa Falls to McCalla, about 28 miles, and the track laid to Buckeye, a distance of 15 miles. (Aug. 30, p. 612.)

EAST CAROLINA.—It is reported that this railroad in North Carolina will be extended 20 miles to Snow Hill. H. C. Bridges, of Tarboro, N. C., is President.

ELIZABETH CITY & WESTERN.—Surveys are reported completed for this projected line in North Carolina, which

is to run from Elizabeth City to a connection with the Seaboard Air Line, 40 miles.

EVANSVILLE & PRINCETON TRACTION.—Right of way has been secured for an electric road to connect the towns in Vanderburg and Gibson Counties in the southwest corner of the State of Indiana.

FITZGERALD, OCMULGEE & RED BLUFF.—An application has been received by the Secretary of State of Georgia for a charter for a railroad 50 miles long, to run from Fitzgerald to Helena, in Telfair County, and thence to Montgomery County, Ga.

FONDA, JOHNSTOWN & GLOVERSVILLE.—An officer writes that the contract for grading and masonry on a section of 10 miles east from Amsterdam, N. Y., has been let to Pitt, Hankin & Trundle, of Richmond, Va. (Construction Supplement, Oct. 11, 1901.)

GASPE & WESTERN.—This company is reported as seeking incorporation to build a railroad from Fraserville, Que., to Gaspé Basin, on the Gulf of St. Lawrence, about 260 miles northeast.

GEORGIA R. R.—It is said that this company contemplates extending its line from Covington, Ga., to Logansville, where a connection could be made with the Seaboard Air Line. This would require 20 miles of railroad to be built.

HARRIMAN & NORTHEASTERN.—This company is said to be considering the further extension of its line in Tennessee, a distance of 50 miles, into Rome and Morgan counties. It is at present in operation between Harriman and Petros, Tenn., 20 miles. A. T. Rodas, Harriman, Tenn., is General Manager.

INDIANA ROADS (ELECTRIC).—A company in Bloomfield, Ind., has secured a franchise to build an electric line connecting the towns of Bloomfield, Elliston, Worthington, Switz City, Lyons, Linton, Jasonville, Midland and other towns in Greene County, a total distance of about 32 miles. These projected lines parallel existing routes of the Illinois Central, Evansville & Terre Haute, Chicago, Indianapolis & Louisville and other railroads.

INTERCOLONIAL.—A movement is on foot for the construction of a direct line as straight as possible between Rivière du Loup, on the St. Lawrence River, Quebec, and Moncton, N. B., to do away with the long haul to tide-water by way of Bay Chaleur, and to open up an important district of country now without a railroad. The entire distance between Rivière du Loup and Moncton would be about 413 miles, and the Temiscouata R. R., now in operation, covers 113 miles of the distance. It is thought that this could easily be acquired and the project is strongly urged by ocean steamship men.

KITTANNING & LEECHBURG (ELECTRIC).—Surveys are reported and rights of way being obtained from Ford City to Leechburg, Pa., 12 miles, and it is planned to begin work on an electric line early next year. When the plans and specifications are completed, it is thought that bids will be asked at once. The Kittanning & Ford City Street Ry. Co. is the promoter.

LACKAWANNA & WYOMING VALLEY RAPID TRANSIT (ELECTRIC).—This company, which controls the Scranton & Northeastern, the Central Valley, Northern Lackawanna and other street railroads in Lackawanna and Luzerne Counties, Pa., has, it is said, secured all necessary franchises and rights of way for its different lines, and has already spent about a million dollars in the work. The main line, 32 miles long, will connect Carbondale and Wilkesbarre, passing through Scranton and Pittston. It is to be built on private right of way for the entire distance, double track.

LAFAYETTE & INDIANAPOLIS (ELECTRIC).—This company was incorporated, Nov. 12, in Indiana to build a railroad 75 miles long between Lafayette and Indianapolis, passing through Tippecanoe, Clinton, Boone and Marion Counties. The capital stock is \$250,000. The new line will parallel the Cleveland, Cincinnati, Chicago & St. Louis between Indianapolis and Stockwell. The directors of the company are A. O. Behm, H. A. Taylor, George Haywood, C. E. Ruger and W. C. Mitchell, of Lafayette, Ind.

LONG BRANCH COAL R. R.—A petition has been filed in the office of the Secretary of State of Alabama, to incorporate a railroad to run from mile post 409, on the Birmingham Mineral, seven miles to the Long Branch Coal Co.

MARYLAND, SPARROWS POINT & NORTH POINT ELECTRIC.—This company has been incorporated in Baltimore County, Md., with \$250,000 stock, to build an electric line from the eastern part of Baltimore to Sparrows Point and North Point, about 7 miles. Robert S. Carswell and others, of Baltimore, are the incorporators.

MEMPHIS, HELENA & LOUISIANA.—The charter for this projected line in Arkansas and Louisiana, was reported filed at Helena, Ark., Nov. 8. The plans of the projectors include a railroad 222 miles long, with a number of branches, and the part of the road which runs southward from the Louisiana line is already under contract. The capital stock is said to be \$3,400,000 and the first Board of Directors elected Nov. 6, is composed of George Gould, G. C. Warner, Russell Harding, F. W. Ireland, G. E. Coda, B. S. Johnson, J. J. Horner, Leon Berton and E. S. Ready.

MINNESOTA & IOWA ELECTRIC.—This company has been incorporated in Minnesota to build an electric line from Decorah, Iowa, by way of Preston and Chatfield, Minn., to reach eventually St. Paul and Minneapolis. The distance from Decorah to Preston and Chatfield, which is the extent of the work contemplated at present, is 47 miles. H. R. Wells is President and Henry Nupson, Treasurer.

NEW CASTLE, CADIZ, MARKLEVILLE, PENDLETON & WESTERN (ELECTRIC).—This company has been organized in Indiana to build an electric road 21 miles long between the points named. Chas. S. Hernly, of New Castle, is General Manager.

ONAWAY & NORTH MICHIGAN.—The contract for this new line 5½ miles long in Presque Isle County, Mich., has been let to W. E. Tench & Co., of Caro.

ONTARIO ROADS (ELECTRIC).—The information that United States and Canadian capitalists have formed a company to build an electric line from Toronto to Cornwall, Ont., with a branch line from Brockville to Ottawa, is announced in the Consular reports. A line such as indicated could not be less than 325 miles long.

OREGON SHORT LINE.—It is said that the new Houston branch, which has recently been completed from Blackfoot, Idaho, to Mackay, 85 miles, will be extended to Salmon City, a distance of about 80 miles further, within the next few months. (Construction Supplement, Oct. 11, 1901.)

PACIFIC NORTHERN & OMINECA.—Application is being made to the British Columbia Legislature for an act to amend the articles of incorporation and give the company power to build a branch line from a point at or near Hazelton, B. C., on the main line, by the easiest route,

following the general direction of Bulkley River to a point at or near its junction with the Tulqua River in Cassiar District, N. W. T., about 100 miles southeast. (Construction Supplement, Oct. 11, 1901.)

PEACE RIVER.—A bill is to be introduced at the next session of the Canadian Parliament to revive the charter of the Edmonton & Lesser Slave Lake under this new name. The purpose of the company is to build a railroad in Northwest Territory through to the Pacific coast at Port Simpson, via the Peace River Pass, which may serve as the Pacific Coast Division of the Canadian Northern. (See Edmonton & Lesser Slave Lake, Sept. 6, p. 628.)

PENNSYLVANIA.—Improvements are to be made at Harrisburg, Pa., involving the filling of the old Pennsylvania Canal opposite the passenger station, and the location of a number of new tracks on this land.

PENNSYLVANIA ROADS.—Surveys are reported for a number of small lines around Monaca and Beaver, Pa., to develop industrial locations in that vicinity. The proposed lines, it is said, are to be operated under joint proprietorship by the Pennsylvania and the Pittsburgh & Lake Erie, and one line which is to run from a connection with the Pittsburgh & Lake Erie just west of Beaver to the Cleveland & Pittsburgh, and Fort Wayne roads at Van Port, will form a cut-off by which traffic can be transferred from one of these lines to the other.

REPUBLIC & GRAND FORKS.—An officer writes that the grading is completed for 35 miles on this proposed line in British Columbia, which is being built by Chas. Ferguson & Co., of Grand Forks, contractors. Two miles of track have been let and 700 men and teams are at work. The rails and rolling stock required are all on hand, and it is said that the line will be in operation next January.

ST. LOUIS & SAN FRANCISCO.—Authority has been asked from the Railroad Commission to issue stock to the amount of \$200,000, and a like amount of bonds on about seven miles of this company's line from Red River to Denison and Sherman, Texas. The track is reported laid at present between Sherman and Cellina, 30 miles, and grading is practically completed on 30 miles additional.

TALOGA & EASTERN.—This company has been incorporated with \$200,000 capital stock to build a new line in Oklahoma out of Taloga. M. C. Edwards, of Kansas City, Mo., and Frank Rinehart, of Guthrie, Okla. T., are interested.

TENNESSEE ROADS.—It is stated that a railroad six miles long from Petros to Oliver Springs is to be built by the State of Tennessee. The State owns mines at Petros and the new road will afford a connection with the Southern.

TENNESSEE ROADS (ELECTRIC).—A project is reported for an electric road 50 miles long between Rogersville and Bristol, Tenn., backed by capital from Philadelphia and Fall River. M. Bachman, of Clover Bottom, Tenn., is said to be interested.

TILSONBURG, LAKE ERIE & PACIFIC.—The contract for the steel work and ballasting on this new line between Tilsonburg and Ingersoll, Ont., 17 miles, has been let to Dart & Hamilton, of Tilsonburg, Ont. (Construction Supplement, Oct. 11, 1901.)

UNADILLA VALLEY.—Surveys are reported for a new line from Bridgewater, N. Y., which is the northern terminus of the above-named railroad and also a junction point with the Delaware, Lackawanna & Western to Utica. Two routes have been surveyed, one-keeping on the east side of the Unadilla River and Sauquoit Creek, making a line 18 miles long, and the other going by way of West Winfield, 20 miles long.

WARREN & CORSICANA PACIFIC.—An application has been filed at Austin, Texas, for authority to issue bonds at the rate of \$15,000 a mile on 20 miles of road, from Warren, in Tyler County, to the terminus in Polk County, to provide for extensions and betterment of the line. Two hundred and twenty-five miles of this road are projected, and 20 miles are at present in operation as a logging road with passenger accommodations.

WABASH & ROCHESTER (ELECTRIC).—An arrangement for the purchase of franchises and rights of way for this company, incorporated June 27, is said to have been completed. The proposed line will be 34 miles long in the State of Indiana, and towns included in its route have subscribed bonuses to the amount of \$100,000. The estimated cost of building is \$750,000. It is said that work will be begun as soon as material can be secured. (Construction Supplement, Oct. 11, 1901.)

WESTERNPORT & LONAICONING ELECTRIC.—A company by this name has been incorporated in Maryland to build an electric railroad 10 miles long between the points named. J. W. Burchinal, of Moundsville, W. Va., is said to be interested.

WOODBURY & NASHVILLE.—Cannon County, Tenn., subscribed, on Nov. 9, \$138,000 to this company to aid it in building its projected line, which is to connect with the Tennessee Central and the Nashville, Chattanooga & St. Louis, near Bell Buckle, Tenn. This is the second election which has been held, the first proposition having been defeated. (Construction Supplement, Oct. 11, 1901.)

WOODSTOCK & CENTREVILLE.—It is reported that the contract has been let to a New York company for building this projected line from Woodstock, Ont., 75 miles northeast. It is said that work will commence next spring and that the line will be completed within 18 months thereafter.

GENERAL RAILROAD NEWS.

ALABAMA & TENNESSEE.—A mortgage for \$2,000,000 has been filed with the Knickerbocker Trust Co., of New York. The railroad is projected to run from Florence, Ala., to Clifton, Tenn., 64 miles, and a portion of this route is already graded.

ATCHISON, TOPEKA & SANTA FE.—The Santa Fe, Prescott & Phoenix was turned over to the above company on Nov. 8, the Atchison, Topeka & Santa Fe having acquired a majority of its stock, and \$2,963,000 of the 5 per cent. second mortgage bonds. The road, with branches, is 224 miles long, 4 ft. 8½ in. gage.

ATLANTIC & DANVILLE.—Additional first mortgage 4 per cent. gold bonds of 1948 have been listed by the New York Stock Exchange, bringing the total amount listed to \$3,925,000.

BOSTON & MAINE.—Gross earnings from operation for the three months ending Sept. 30, 1901, were \$8,680,462, an increase of \$316,878 over the same period last year. For purpose of comparison, the earnings from elevators and stock yards were transferred from "income from other sources" to "gross earnings from operation." The operating expenses for the three months were \$5,809,815, as against \$5,550,698, leaving a net income from all sources \$2,982,518 for the three months this year, as against \$2,931,503 last year. After deducting interest, rentals and taxes, there remained as

surplus \$982,707 this year, and \$921,218 for the same three months last year, an increase this year of \$61,488.

BROOKLYN RAPID TRANSIT.—The comparative statement for the months of July, August and September, 1901 and 1900, shows gross receipts this year of \$3,433,600, an increase of \$207,142 over last year's figure. After deducting the expenses, including taxes, however, the net receipts were \$1,174,477, a decrease of \$90,438 over the figure for the same three months last year. The mileage increased by about half a mile.

CHESTNUT RIDGE.—This railroad, 11 miles long, in the west end of Monroe County, is to be sold on Nov. 30. It was organized in 1898 and opened in January, 1900, between Kunkletown and Lehigh Gap, and has capital stock to the extent of \$51,080, and also \$40,000 in bonds outstanding.

CINCINNATI, GEORGETOWN & PORTSMOUTH.—The proposition to increase this company's capital stock from \$525,000 to \$1,500,000, and to make a mortgage to secure \$1,500,000 of 5 per cent. bonds, will be voted on by the shareholders at Cincinnati, Dec. 30. There is an existing 4 per cent. mortgage for \$500,000, created in 1900, of which \$252,000 has been issued to take up old 6s. It is thought that enough of the new issue will be reserved to retire at or before maturity these 4 per cent. 1900 bonds.

DELAWARE, LACKAWANNA & WESTERN.—At a recent conference between the members of the Board of Works, Newark, and the railroad officials, it was agreed that the city's share in the proposed Newark track elevation shall be \$600,000, instead of \$1,000,000, as previously asked by the company. The expense is based upon a calculation of 25 per cent. of the total cost.

KANSAS CITY, WATKINS & GULF.—This Louisiana road, which has been in the hands of a receiver for over three years, is to be reorganized. It extends from Lake Charles to Alexandria, La., 98 miles, with two short spurs additional. It was chartered in 1887 and completed between the points named in 1892. It has at present a net deficit of \$330,512, but earned in the year ending June 30, 1900, a gross surplus of \$56,537.

KINGSTON & PEMBROKE.—This Ontario line, extending between Kingston and Renfrew, 103 miles, with two short branches, has been taken over by the Canadian Pacific, and on and after Jan. 1, 1902, will be operated as the Kingston & Pembroke Division of the above. For a list of officers, see Elections and Appointments column.

LITTLE KANAWHA.—The report that this road has been sold is confirmed by President Jackson, but he denies the statement that the sale was "to Stephen B. Elkins, representing a syndicate, for \$1,250,000, of which \$1,000,000 was paid down and the remainder is to be paid Nov. 10," as printed in the *Railroad Gazette*, Nov. 8 (p. 782). The general impression is that the Elkins Syndicate (which is back of the West Virginia Central & Pittsburgh) is concerned in the purchase.

NORTHERN PACIFIC.—At a recent meeting of the directors it was voted to call the preferred stock for redemption, and in accordance with this decision the entire issue of \$75,000,000 will be retired at par Jan. 1, 1902. The directors voted to provide the funds necessary for this action by the sale at not less than par of \$75,000,000 4 per cent. bonds, which may be converted into common stock. After this conversion has taken place, the company's entire \$155,000,000 of stock will be of one class without preference.

NORTHERN SECURITIES COMPANY.—After we went to press last week the announcement was made of the incorporation of this company the purpose of which is to buy and hold the securities of the Great Northern and Northern Pacific Railroads. It was incorporated in New Jersey, the authorized capital stock being \$400,000,000. The preferred stock of the Northern Pacific (the ownership of which by the Union Pacific was one of the complications of the situation) is to be retired Jan. 1, and the common will be exchanged for the stock of the Northern Securities Company at 100 Northern Pacific for 115 Northern Securities. The stock of the Great Northern goes in at 180 Northern Securities for 100 Great Northern. The officers and directors of the new company are given in our column of elections and appointments. To take up the Northern Pacific stock (after retirement and conversion of the preferred) will absorb \$178,250,000 of Northern Securities stock, and the Great Northern stock will absorb \$225,000,000, or a total of \$403,250,000. The interest of the Union Pacific in the Northern securities is said to be somewhere from 20 to 25 per cent. of the entire issue, and the Union Pacific has three directors in the board of the new company. Meanwhile another company has been created, namely, the Chicago, Burlington & Quincy Railway Company, to lease and operate the property of the Chicago, Burlington & Quincy Railroad Company. The capital of this company will be \$100,000,000, one-half to be held in Union Pacific interests and the other half by the Great Northern and Northern Pacific interests. This stock does not represent purchase or capitalization but an arrangement for administration, and is practically a voting trust. It seems to be the purpose that the Northern Pacific, the Great Northern, and the Burlington shall be worked by complete and separate organizations which doubtless is necessary under the laws of the various Northwestern States.

SEABOARD COMPANY.—This company was incorporated under the laws of New Jersey, Nov. 11, with \$5,000,000 authorized capital stock, to take over from the party in control, it is said, a mortgage of the \$47,000,000 capital stock of the Seaboard Air Line in exchange for stock of its own, and class A and class B debenture bonds for the preferred and common shares respectively. Official information about this plan of reorganization, however, has not been given out.

TOLEDO, ST. LOUIS & WESTERN.—Vermilye & Co., and Hallgarten & Co., offer for sale the remainder of an issue of \$9,000,000 prior lien 3½ per cent. gold bonds of 1925, of which the Farmers' Loan & Trust Co., New York, is trustee. Provision is made for the issue, after Jan. 1, 1902, of \$1,000,000 additional bonds at the rate of not more than \$250,000 in any one year, and then only for additions and betterments of the property under restrictions provided in the mortgage. About one-half of this issue has been placed already, and the balance is offered at 90½ plus the accrued interest to date.

VELASCO, BRAZOS & NORTHERN.—Authority has been asked of the Texas Railroad Commission to issue bonds at the rate of \$11,376 per mile on 20 miles of the company's line now in operation between Velasco and Anchor, Texas. The Velasco, Brazos & Northern is the reorganized Velasco Terminal, and the amount of the bonds which are asked in place of the old bonds is determined by the valuation fixed upon the railroad property by the State Commissioners.